This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

B 435749

LIBRARY OF THE
UNIVERSITY OF MICHIGAN

READING
ROOM

SB
45
.B16
1900
copy 2

CYCLOPEDIA OF AMERICAN HORTICULTURE

The
Co.

Plate X. Prominent American Horticulturists.

CYCLOPEDIA OF
AMERICAN HORTICULTURE

106132

COMPRISING SUGGESTIONS FOR CULTIVATION OF HORTICULTURAL PLANTS, DESCRIPTIONS OF THE SPECIES OF FRUITS, VEGETABLES, FLOWERS AND ORNAMENTAL PLANTS SOLD IN THE UNITED STATES AND CANADA, TOGETHER WITH GEOGRAPHICAL AND BIOGRAPHICAL SKETCHES

BY

L. Liberty H. Hyde BAILEY

Professor of Horticulture in Cornell University

ASSISTED BY

WILHELM MILLER, PH.D.

Associate Editor

AND MANY EXPERT CULTIVATORS AND BOTANISTS

Illustrated with over
Two Thousand Original Engravings

IN FOUR VOLUMES
E-M

New York
THE MACMILLAN COMPANY
LONDON: MACMILLAN & CO., LTD.
1901

The rights of reproduction and of translation are strictly reserved

Copyright, 1900,
By THE MACMILLAN COMPANY

Mount Pleasant Printery
J. Horace McFarland Company
Harrisburg, Pa.

COLLABORATORS

I. PARTIAL LIST OF CONTRIBUTORS TO THE CYCLOPEDIA

The asterisk designates the contributors to the second volume. Many of the contributors have also assisted in reading proofs and in other ways.

ADAMS, GEO. E., Asst. Horticulturist, R. I. Exp. Sta., Kingston, R. I. (*Rhode Island.*)

***AMES, OAKES**, Asst. Dir. Botanic Garden, and Instructor in Botany in Harvard Univ., Cambridge, Mass. (*Several genera of Orchids.*)

***ARCHDEACON & CO.**, Commission merchants, New York, N. Y. (*Mushroom.*)

ARNOLD, JR., GEO., Florist, Rochester, N. Y. (*China Aster.*)

ARTHUR, Prof. J. C., Purdue Univ., Lafayette, Ind. (*Physiology of Plants.*)

***ATKINSON, GEO. F.**, Prof. of Botany, Cornell Univ., Ithaca, N. Y. (*Mushroom.*)

BALMER, Prof. J. A., Horticulturist, Wash. Exp. Sta., Pullman, Wash. (*Washington.*)

***BARCLAY**, F. W., Gardener, Haverford, Pa. (*Herbaceous Perennials, Aster, Eryngium, etc.*)

***BARNES, CHARLES R.**, Prof. of Plant Physiology, Univ. of Chicago, Chicago, Ill. (*Fertilization. Flower.*)

***BARNES, WILLIAM H.**, Secretary Kans. Hort. Soc., Topeka, Kans. (*Kansas.*)

***BAYERSDORFER**, H., Dealer in florists' supplies, Philadelphia, Pa. (*Everlasting flowers.*)

BEACH, Prof. S. A., Horticulturist, N. Y. Exp. Sta., Geneva, N. Y. (*Corn. Thinning.*)

BEADLE, C. D., Botanist and horticulturist, Biltmore, N C. (*Bamboo.*)

***BEAL**, Prof. W. J., Mich. Agric. College, Agricultural College, Mich. (*Grass. Has read proofs of many genera of grasses.*)

BECKERT, THEO. F., Florist, Allegheny City, Pa. (*Bougainvillæa.*)

***BERCKMANS**, P. J., Pomologist and nurseryman, Augusta, Ga. (*Lawns for the South. Magnolia. Melia. Michelia. Has read proof of many groups of importance in the South.*)

***BLAIR**, Prof. J. C., Horticulturist, Ill. Exp. Sta., Champaign, Ill. (*Greenhouse Glass. Illinois.*)

***BRANDEGEE**, Mrs. **KATHARINE**, Botanist, editor of Zoë, San Diego, Calif. (*Mammillaria, Melocactus, and other cacti.*)

***BRUCKNER, NICHOL N.**, Dreer's Nursery, Riverton, N. J. (*The article "Ferns." Many groups of tender ferns.*)

BUFFUM, Prof. B. C., Horticulturist, Wyo. Exp. Sta., Laramie, Wyo. (*Wyoming.*)

***BURNETTE**, Prof. F. H., Horticulturist, La. Exp. Sta., Baton Rouge, La. (*Louisiana.*)

BUTZ, Prof. **GEO.** C., Asst. Horticulturist, Pa. Exp. Sta., State College, Pa. (*Carnation. Pennsylvania.*)

***CAMERON, ROBERT**, Gardener, Botanic Garden of Harvard Univ. (*Various articles and much help on rare plants. Alpinia, Campanula, Echinocactus, etc.*)

***CANNING, EDWARD J.**, Gardener, Smith College, Botanic Gardens, Northampton, Mass. (*Many articles and much help on rare and difficult plants. Anthurium, Echinocactus, Epiphyllum, Gloxinia, etc.*)

***CARD**, Prof. **FRED** W., Horticulturist, R. I. Exp. Sta., Kingston, R. I. (*Nebraska. Botany and culture of bush-fruits, as Amelanchier, Berberis, Blackberry, Buffalo Berry, Currant, Loganberry.*)

***CLINKABERRY, HENRY T.**, Gardener, Trenton, N J. (*Certain orchids, as Lælia.*)

COOK, O. F., Div. of Botany, Section of Seed and Plant Introduction, Dept. of Agric., Washington, D. C. (*Coffee.*)

CORBETT, Prof. L. C., Horticulturist, W. Va. Exp. Sta., Morgantown, W. Va. (*West Virginia.*)

***COULSTON**, Mrs. M. B., Formerly assistant editor of Garden and Forest, Ithaca, N. Y. (*Mitchella, and some other native plants.*)

***COULTER, JOHN M.**, Professor and Head of the Dept. of Botany, Univ. of Chicago, Chicago, Illinois. (*Echinocactus.*)

***COWEN**, J. H., formerly Assistant in Horticulture, Colo. Exp. Sta., Ithaca, N. Y. (*Certain Colorado plants, as Lepachys, Leucocrinum.*)

***CRAIG**, Prof. **JOHN**, Horticulturist, Ia. Exp. Sta., Ames, Ia. (*Canada. Gooseberry. Kale. Kohlrabi.*)

CRAIG, ROBERT, Florist, Philadelphia, Pa. (*Araucaria. Ardisia. Codiæum.*)

***CRAIG**, W. N., Gardener, North Easton, Mass. (*Mushroom.*)

CRANDALL, Prof. C. S., Horticulturist, Colo. Exp. Sta., Fort Collins, Colo. (*Colorado.*)

*Cushman, E. H., Gladiolus specialist, Euclid, Ohio. (_Gladiolus._)

*Darlington, H. D., Wholesale florist, specialis in heaths and hard-wooded plants. (_Epacris. Leptospermum. Has read proof of many articles on hard-wooded plants._)

*Davis, K. C., Science teacher, Ithaca, N. Y. (_Genera in Ranunculaceæ._)

*Davy, J. Burtt, Asst. Botanist, Univ. of Calif. Exp. Sta., Berkeley, Calif. (_Acacia. Eucalyptus. Maytenus. Myrtaceæ._)

*Deane, Walter, Botanist, Cambridge, Mass. (_Herbarium. Has helped on various botanical problems._)

*Dewey,, Lyster J., Div. of Botany, Dept. of Agric., Washington, D. C. (_Mentha._)

Dorner, Fred, Carnation specialist, Lafayette Ind. (_Carnation._)

Dorsett, P. H., Associate Physiologist and Pathologist, Dept. of Agric., Washington, D.C. (_Violet._)

*Douglas, Thos. H., of R. Douglas & Sons, nurserymen and specialists in conifers, Waukegan, Ill. (_Larix._)

Duggar, B. M., Asst. Cryptogamic Botanist, Cornell Exp. Sta., Ithaca, N. Y. (_Pollen._)

*Dunning, D. M., Amateur, Auburn, N. Y. (_Grapes under Glass._)

*Dupuy, Louis, Wholesale florist and specialist in hard-wooded plants, College Point, L. I. (_Erica. Has read other articles on heath-like plants._)

Earle, Prof. F. S., Horticulturist, Ala. Polytechnic Institute, Auburn, Ala. (_Alabama._)

Earle, Parker, Horticulturist, Roswell, N. M. (_New Mexico._)

*Egan, W. C., Amateur, Highland Park, Ill. (_Eremurus. Has helped on hardy plants._)

Eisele, J. D., Foreman Dreer's Nursery, Riverton, N. J. (_Cordyline._)

Elliott, William H., Florist, Brighton, Mass. (_Asparagus plumosus._)

*Emery, S. M., Director Mont. Exp. Sta., Bozeman, Mont. (_Montana._)

*Endicott, John, Bulb-grower, Canton, Mass. (_Littonia._)

*Endicott, W. E., Teacher, Canton, Mass. (_Achimenes. Acidanthera. Ixia. Has made important corrections in many articles on bulbs._)

Evans, Walter H., Office of Exp. Stations, Dept. of Agric., Washington, D. C. (_Alaska._)

*Fawcett, Wm., Dir. Dept. Public Gardens and Plantations, Kingston, Jamaica. (_Tropical fruits, as Cherimoya, Marmalade Plum, Egg Fruit, Mango, Mangosteen, Nutmeg_)

*Fernow, Prof. B. E., Dir. College of Forestry, Cornell Univ., Ithaca, N. Y. (_Conifers. Forestry._)

Finlayson, Kenneth, Gardener, Brookline, Mass. (_Diosma._)

*Fletcher, S. W., Horticulturist, Ithaca, N. Y. (_Ipomœa and other Convolvulaceæ. Helianthus and related genera._)

*Franceschi, Dr. F., Manager S. Calif. Acclimatizing Ass'n, Santa Barbara, Calif. (_Rare plants of S. Calif., as Dasylirion, Flacourtia, Fouquiera, Furcræa, Hazardia, etc. Has read many proofs and made numerous corrections._)

*Galloway, B. T., Chief Div. Veg. Phys. and Path., Dept. of Agric., Washington, D. C. (_Floriculture. Has read articles on fungi._)

*Garfield, C. W., Horticulturist, Grand Rapids, Mich. (_Michigan._)

*Gerard, J. N., Amateur, Elizabeth, N. J. (_Many articles, especially on bulbous plants, as Crocus, Iris, Muscari, Narcissus._)

*Gillett, Edward, Nurseryman, Southwick, Mass. (_Hardy Ferns. Liparis. Has read numerous proofs on native plants._)

Goff, Prof. E. S., Horticulturist, Wis. Exp. Sta., Madison, Wis. (_Wisconsin._)

Gould, H. P., Asst. Entomologist and Horticulturist, Md. Exp. Sta., College Park, Md. (_Brussels Sprouts. Celeriac._)

*Green, Prof. S. B., Horticulturist, Minnesota Exp. Sta., St. Anthony Park, Minn. (_Minnesota._)

*Green, Wm. J., Horticulturist, Ohio Exp. Sta., Wooster, Ohio. (_Ohio. Greenhouse sub-irrigation._)

*Greenlee, Miss Lennie, Bulb-grower, Garden City, N. C. (_Ixia._)

*Greiner, T., Specialist in vegetables, La Salle, N. Y. (_Garden vegetables, as Artichoke, Asparagus, Bean, Cress, Corn Salad, Kohlrabi, Lettuce._)

*Grey, Robert M., Gardener, North Easton, Mass. (_Numerous important orchid groups, as Cypripedium, Epidendrum, Lycaste, Maxillaria, Masdevallia._)

*Groff, H. H., Gladiolus specialist, Simcoe, Ont. (_Gladiolus._)

Gurney, James, Gardener, Mo. Botanical Garden, St. Louis, Mo. (_Cacti._)

Hale, J. H., Nurseryman and pomologist, South Glastonbury, Conn. (_Connecticut._)

*Halsted, Prof. B. D., Rutgers College, New Brunswick, N. J. (_Diseases. Fungus._)

*Hansen, Geo., Landscape architect and botanist, Berkeley, Calif. (_Epidendrum._)

Hansen, Prof. N. E., Horticulturist, S. Dak. Exp. Sta., Brookings, S. Dak. (_South Dakota._)

*Harris, F. L., Gardener, Wellesley, Mass. (_Lisianthus. Medinilla._)

*Harris, W., Acting Dir., Dept. Public Gardens and Plantations, Kingston, Jamaica. (_Mammee Apple and some other tropical fruits._)

*Harris, W. K., Florist, Philadelphia, Pa. (_Ficus elastica. Help on Lilium Harrisii._)

*Hasselbring, Heinrich, Asst. in Botany, Cornell Univ., Ithaca, N. Y. (_Iris and most orchids from Gongora to Masdevallia._)

*Hastings, G. T., Asst. in Botany, Cornell Univ., Ithaca, N. Y. (_Some tropical plants, as Berria, Bertholletia. A few grasses, as Hierochloe, Holcus, Hordeum._)

*Hatfield, T. D., Gardener, Wellesley, Mass. (_Numerous and varied contributions, as Gesnera, Gloxinia, Lachenalia, Leea, Macrozamia._)

*Hedrick, U. P., Asst. Prof. of Horticulture, Agricultural College, Mich. (_Evaporation of Fruit._)

*Henderson & Co., Peter, Seedsmen, 37 Cortlandt St., New York, N. Y. (_Bulbs. Eccremocarpus._)

*Herrington, A., Gardener, Florham Farms, Madison, N. J. (_Chrysanthemum coccineum. Hollyhock._)

*Hexamer, Dr. F. M., Editor American Agriculturist, New York, N. Y. (_Several biographical sketches, as Fuller, Harris._)

Hicks, G. H., late of Dept. of Agric., Washington, D. C. (_Seed-testing._)

*Hicks, Henry, Nurseryman, Westport, L. I. (_Ligustrum._)

*Higgins, J. E., Horticulturist and teacher, Honolulu, H. I. (_Hawaiian Islands._)

Hill, E. G., Florist, Richmond, Ind. (_Begonia._)

*Hitchcock, A. S., Prof. of Botany, Kansas State Agric. College, Manhattan, Kans. (_Most of the genera of grasses in the second volume._)

*Hoopes, Josiah, Nurseryman, West Chester, Pa. (_Hedges._)

*Horsford, Fred. H., Nurseryman and specialist in Lilies, Charlotte, Vt. (_Alpine Gardens. Lilium. Has read proof of many articles on native plants._)

*Hunn, Charles E., Gardener, Cornell Exp. Sta., Ithaca, N. Y. (_Forcing of Vegetables. Mignonette._)

*Huntley, Prof. F. A., Idaho Exp. Sta., Moscow, Idaho. (_Idaho._)

Hutchins, Rev. W. T., Sweet Pea specialist, Indian Orchard, Mass. (_Sweet Pea._)

*Irish, H. C., Horticulturist, Mo. Botanical Garden, St. Louis, Mo. (_Capsicum. Lactuca._)

Jackson & Perkins Co., Nurserymen and specialists in Clematis, Newark, N. Y. (_Clematis._)

*Jeffers, A., Editor "Cornucopia," Norfolk, Va. (_Kale._)

Jordan, A. T., Asst. Horticulturist, New Brunswick, N. J. (_New Jersey._)

*Kains, M. G., Div. of Botany, Dept. of Agric., Washington, D. C. (_Minor vegetables, as Horse-Radish. Herbs, as Hyssopus; also Ginseng and Glycyrrhiza._)

*Kearney, Jr., T. H., Div. of Botany, Dept. of Agric., Washington, D. C. (_Three orchid genera, Grammangis, Grammatophyllum, Habenaria._)

*Keller, J. B., Florist, Rochester, N. Y. (_Many groups of hardy herbaceous perennials. Article on "Herbaceous Perennials."_)

*Kelsey, Harlan P., Landscape architect, Boston, Mass. (_North Carolina plants, as Galax and Leucothoë._)

Kennedy, P. Beveridge, Horticulturist, Nev. Exp. Sta., Reno, Nev. (_Many genera of grasses. Begonia._)

*Kerr, J. W., Nurseryman, Denton, Md. (_Maryland._)

Kift, Robert, Florist, Philadelphia, Pa. (_Cut-flowers._)

Kinney, L. F., Horticulturist, Kingston, R. I. (_Celery._)

Lager & Hurrell, Orchid cultivators, Summit, N. J. (_Cattleya._)

Lake, Prof. E. R., Horticulturist, Ore. Exp. Sta., Corvallis, Ore. (_Oregon._)

*Landreth, Burnet, Seedsman, Philadelphia, Pa. (_David Landreth._)

*Lauman, G. N., Instructor in Horticulture, Cornell Univ., Ithaca, N. Y. (_Geranium. Impatiens. Pelargonium._)

Lonsdale, Edwin, Florist, Chestnut Hill, Philadelphia, Pa. (_Conservatory._)

*Lord & Burnham Co., Horticultural architects and builders, Irvington-on-Hudson, N. Y. (_Greenhouse Construction._)

Lothrop & Higgins, Dahlia specialists, East Bridgewater, Mass. (_Dahlia_)

*MacPherson, James, Landscape gardener, Trenton, N. J. (_Euphorbia. Has read proof of several orchid genera._)

*Manning, J. Woodward, Horticultural expert and purchasing agent, Boston, Mass. (_Pyrethrum. Hardy herbs. Has read proof of many groups of herbaceous perennials._)

*Manning, Warren H., Landscape architect, Boston, Mass. (_Article, "Herbaceous Perennials."_)

*Mason, Prof. S. C., Berea, Ky. (_Labeling. Layering._)

*Massey, Prof. W. F., Horticulturist, N. C. Exp. Sta., Raleigh, N. C. (_Figs. North Carolina._)

Mathews, F. Schuyler, Artist, 2 Morley St., Boston, Mass. (_Color._)

*Mathews, Prof. C. W., Horticulturist, Ky. Exp. Sta., Lexington, Ky. (_Kentucky._)

*Mathews, Wm., Florist and orchid grower, Utica, N. Y. (Various rare and important orchids, _as Gongora, Grammatophyllum, Ionopsis, Limatodes, Miltonia._)

*Maynard, Prof. S. T., Horticulturist, Mass. Hatch Exp. Sta., Amherst, Mass. (*Massachusetts.*)

McDowell, Prof. R. H., Reno, Nev. (*Nevada.*)

McFarland, J. Horace, Horticultural printer and expert in photography, Harrisburg, Pa. (*Border.*)

*McMillen, Robert, Wholesale grower of mignonette, Pearl River, N. Y. (*Mignonette.*)

*McWilliam, Geo., Gardener, Whitinsville, Mass. (*Dipladenia. Luculia.*)

Mead, T. L., Horticulturist, Oviedo, Fla. (*Crinum. Has helped in matters of extreme southern horticulture.*)

*Meehan, Joseph, Nurseryman, Germantown, Philadelphia, Pa. (*Idesia.*)

*Meredith, A. P., Gardener, South Lancaster, Mass. (*Humea.*)

Moon, Samuel C., Nurseryman, Morrisville, Pa. (*Trees for ornament.*)

*Morris, O. M., Asst. Horticulturist, Okla. Exp. Sta., Stillwater, Okla. (*Indian Territory. Oklahoma.*)

*Munson, T. V., Nurseryman and grape hybridist, Denison, Tex. (*Grape culture in the South.*)

*Munson, Prof. W. M., Horticulturist, Me. Exp. Sta., Orono, Me. (*Maine.*)

Newell, A. J., Gardener, Wellesley, Mass. (*Certain orchids.*)

*Norton, J. B. S., Botanical Assistant, Mo. Botanical Garden, St. Louis, Mo. (*Euphorbiaceæ. Manihot. Several botanical puzzles, as Lithræa.*)

Ogston, Colin, Gardener and orchid cultivator, Kimball Conservatories, Rochester, N. Y. (*Dendrobium.*)

*Oliver, G. W., Gardener, U. S. Botanic Gardens, Washington, D. C. (*Many articles on palms, aroids, succulents and rare plants, and much help on proofs. Alstrœmeria. Amaryllis.*)

Orpet, Edward O., Gardener, So. Lancaster, Mass. (*Many articles. Border. Cyclamen. Dianthus, and certain orchids.*)

*Parsons, Jr., Samuel, Landscape architect, New York, N. Y. (*Lawn.*)

Peacock, Lawrence K., Dahlia specialist, Atco, N. J. (*Dahlia.*)

Powell, Prof. G. Harold, Horticulturist, Del. Exp. Sta., Newark, Del. (*Cherry. Delaware.*)

Price, Prof. R. H., Horticulturist, Tex. Exp. Sta., College Station, Tex. (*Texas.*)

*Purdy, Carl, Specialist in California bulbs, Ukiah, Calif. (*California native plants, as Brodiæa, Calochortus, Erythronium, Fritillaria.*)

Rane, Prof. F. W., Horticulturist, N. H. Exp. Sta., Durham, N. H. (*New Hampshire.*)

*Rawson, Grove P., Florist, Elmira, N. Y. (*Lantana.*)

*Rawson, W. W., Seedsman and market-gardener, Boston, Mass. (*Cucumber. Lettuce.*)

*Reasoner, E. N., Nurseryman and horticulturist, Oneco, Fla. (*Many articles, and much help on extreme southern horticulture. Cæsalpinia. Cocos. Guava. Kumquat. Lemon. Lime. Mango.*)

*Rehder, Alfred, Specialist in hardy trees and shrubs, Jamaica Plain, Mass. (*Botany and culture of most of the hardy trees and shrubs.*)

*Roberts, Prof. I. P., Dir. College of Agric., Cornell Univ., Ithaca, N. Y. (*Drainage. Fertility. Manure. Potato.*)

*Rolfs, Prof. P. H., Botanist, S. C. Exp. Sta., Clemson College, S. C. (*Eggplant. Florida.*)

Rose, J. N., Asst. Curator, U. S. Nat. Herb., Smithsonian Institution, Washington, D. C. (*Agave.*)

Rose, N. Jonsson, Landscape Gardener to New York City Parks, New York, N. Y. (*Various exotics.*)

*Roth, Filibert, Asst. Prof. of Forestry, N. Y. State College of Forestry, Cornell Univ., Ithaca, N. Y. (*Fagus.*)

*Rowlee, Prof. W. W., Asst. Prof. of Botany, Cornell Univ., Ithaca, N. Y. (*Definitions. Liatris. Nymphæa. Salix.*)

Sargent, Prof. C. S., Dir. Arnold Arboretum, Jamaica Plain, Mass. (*Abies.*)

*Scott, Wm., Florist, Buffalo, N. Y. (*Important florists' plants and flowers, as Acacia, Convallaria, Cyclamen, Cytisus, Smilax, Metrosideros, etc.*)

Scott, Wm., Gardener, Tarrytown, N. Y. (*Bertolonia and other dwarf tender foliage plants.*)

Semple, James, Specialist in China Asters, Bellevue, Pa. (*Aster.*)

*Sexton, Joseph, Founder of the pampas grass industry, Goleta, Calif. (*Gynerium.*)

*Shinn, Charles H., Inspector of Experiment Stations, Univ. of Calif., Berkeley, Calif. (*California, Fig, Loganberry, etc.*)

*Shore, Robert, Gardener, Botanical Dept., Cornell Univ., Ithaca, N. Y. (*Various articles, as Acalypha, Bedding, Dichorisandra, Episcea, Fittonia, Hymenophyllum.*)

*Siebrecht, Henry A., Florist and nurseryman, New York and Rose Hill Nurseries, New Rochelle, N. Y. (*Much help on rare greenhouse plants, particularly orchids and palms. Dracæna. Ficus. Fuchsia. Gardenia. Ixora. Lapageria. Laurus.*)

*Simonds, O. C., Supt. Graceland Cemetery, Buena Ave., Chicago, Ill. (*Landscape Cemeteries.*)

*Slingerland, Prof. M. V., Asst. Prof. Economic Entomology, Cornell Univ., Ithaca, N. Y. (*Insecticides. Insects.*)

Smith, A. W., Cosmos cultivator, Americus, Ga. (*Cosmos.*)

Smith, Elmer D., Chrysanthemum specialist, Adrian, Mich. (*Chrysanthemum.*)

*Smith, Jared G., Div. of Botany, Dept. of Agric., Washington, D. C. (*Nearly all palms. Various genera, as Centaurea, Cerastium, Cotyledon.*)

*Spencer, John W., Fruit-grower, Westfield, Chautauqua Co., N. Y. (*Grapes in the North. Help on important fruits.*)

*Starnes, Prof. Hugh N., Horticulturist, Ga. Exp. St., Athens, Ga. (*Georgia.*)

Stinson, Prof. John T., Dir. Mo. Fruit Exp. Sta., Mountain Grove, Mo. (*Arkansas.*)

*Strong, Wm. C., Nurseryman, Waban, Mass. (*Kenrick.*)

*Taft, Prof. L. R., Horticulturist, Mich. Agric. College, Agricultural College, Mich. (*Greenhouse Heating. Hotbeds.*)

*Taplin, W. H., Specialist in palms and ferns, Holmesburg, Philadelphia, Pa. (*Culture of many palms, ferns and foliage plants.*)

*Taylor, Wm. A., Asst. Pomologist, Div. of Pomology, Dept. of Agric., Washington, D. C. (*Various articles on nuts, as Hickory.*)

*Thilow, J. Otto, of H. A. Dreer, Inc., Philadelphia, Pa. (*Leek. Muskmelon.*)

*Thompson, C. H., formerly Asst. Botanist, Mo. Botanical Garden, St. Louis, Mo. (*Some genera of cacti, as Echinocerus, Epiphyllum.*)

*Thorburn & Co., J. M., Seedsmen, New York, N. Y. (*Hyacinth. Have read many proofs of bulbs, annuals, vegetables, herbs, etc.*)

Toumey, Prof. J. W., Biologist, Ariz. Exp. Sta., Tucson, Ariz. (*Arizona. Date. Opuntia.*)

*Tracy, S. M., Horticulturist, Biloxi, Miss. (*Mississippi.*)

*Tracy, Prof. W. W., Seedsman, Detroit, Mich. (*Cabbage. Lettuce. Michigan.*)

*Trelease, Dr. Wm., Dir. Mo. Botanical Garden, St. Louis, Mo. (*Certain desert plants of the lily family, as Aloe, Apicra, Gasteria, Haworthia.*)

*Tricker, Wm., Specialist in aquatics, Dreer's Nursery, Riverton, N. J. (*Aquarium. Most Aquatics, as Limnanthemum, Limnocharis, Nymphœa, Nelumbium, Victoria, etc.*)

*Troop, Prof. James, Horticulturist, Ind. Exp. Sta., Lafayette, Ind. (*Indiana.*)

*Turner, Wm., Gardener, Tarrytown-on-Hudson, N. Y. (*Forcing of Fruits. Mushroom.*)

Tuttle, H. B., Cranberry-grower, Valley Junction, Wis. (*Cranberry.*)

*Underwood, Prof. L. M., Columbia University, New York, N. Y. (*Botany of all ferns.*)

Van Deman, H. E., Pomologist, Parksley, Va. (*Date.*)

*Vaughan, J. C., Seedsman and florist, Chicago, Ill. (*Christmas Greens.*)

*Vick, James, Editor "Vick's Magazine," Rochester, N. Y. (*Malvaviscus. Melothria.*)

*Voorhees, Prof. Edward B., Dir. N. J. Exp. Sta., New Brunswick, N. J. (*Fertilizers.*)

Waldron, Prof. C. B., Horticulturist, N. Dak. Exp. Sta., Fargo, N. Dak. (*North Dakota.*)

*Walker, Ernest, Horticulturist, Ark. Exp. Sta., Fayetteville, Ark. (*Annuals. Basket Plants. Heliotrope. Watering.*)

*Watrous, C. L., Nurseryman and pomologist, Des Moines, Ia. (*Iowa.*)

*Watson, B. M., Instructor in Horticulture, Bussey Inst., Jamaica Plain, Mass. (*Colchicum. Cuttage. Forcing Hardy Plants. House Plants.*)

Watts, R. L., Horticulturist, Tenn. Exp. Sta., Knoxville, Tenn. (*Tennessee.*)

*Waugh, Prof. F. A., Horticulturist, Vt. Exp. Sta., Burlington, Vt. (*Beet. Carrot. Cucumber. Greens. Lilium. Pentstemon. Salad Plants. Vermont.*)

*Webber, H. J., In charge of Plant Breeding Laboratory, Div. of Veg. Phys. and Path., Dept. of Agric., Washington, D. C. (*Citrus. Murraya and other citrous genera.*)

*Wellhouse, Col. Fred, Fruit-grower, Fairmount, Kans. (*Kansas.*)

*Wheeler, H. J., Dir. R. I. Exp. Sta., Kingston, R. I. (*Lime.*)

*Whitney, Milton, Chief, Div. of Soils, Dept. of Agric., Washington, D. C. (*Irrigation. Soils.*)

*Whitten, Prof. J. C., Horticulturist, Mo. Exp. Sta., Columbia, Mo. (*Missouri.*)

*Whyte, R. B., Amateur, Ottawa, Ont. (*Hemerocallis. Lilium.*)

*Wickson, Edward J., Prof. of Agricultural Practice, Univ. of Calif., and Horticulturist, Calif. Exp. Sta., Berkeley, Calif. (*Almond, Apricot, Cherry, Grape, Lemon, Lime, etc., in California.*)

*Woolson, G. C., Nurseryman, specialist in hardy herbaceous perennials, Passaic, N. J. (*Mertensia. Has read numerous proofs.*)

*Wortman, S. W., Mushroom-grower, Iselin, N. J. (*Mushroom.*)

*Wiegand, K. M., Instructor in Botany, Cornell Univ., Ithaca, N. Y. (*Coreopsis. Cordyline. Cyperus. Dracæna. Juncus. Lysimachia. Musa. Myosotis*).

*Wyman, A. P., Asst. to Olmsted Bros., Landscape Architects, Brookline, Mass. (*Dirca, Epigœa, Exochorda, Halesia, Hypericum, Kerria, Liquidambar, and other hardy trees and shrubs. Also Lathyrus, Lupinus.*)

II. PARTIAL LIST OF THOSE WHO HAVE ASSISTED BY READING PROOF, AND IN OTHER WAYS.

Andrews, D. M., Nurseryman, Boulder, Colo. (*Native western plants, especially new hardy cacti.*)

Ball, C. D., Wholesale florist, Holmesburg, Philadelphia, Pa. (*Ferns. Foliage Plants. Palms.*)

Barker, Michael, Editor "American Florist," Chicago, Ill. (*Many suggestions.*)

Bassett & Son, Wm. F., Nurserymen, Hammonton, N. J. (*Native plants, as Hibiscus.*)

Berger & Co., H. H., New York, N. Y. (*Japanese and Californian plants.*)

Bessey, Chas. E., Prof. of Botany, Univ. of Neb., Lincoln, Neb. (*Native plants, particularly grasses.*)

Betscher Bros., Florists, nurserymen and seedsmen, Canal Dover, Ohio. (*Gladiolus.*)

Blanc, A., Seedsman and plantsman, Philadelphia, Pa. (*Cacti. Novelties.*)

Boardman, S. L., Sec. Maine Hort. Soc., Augusta, Me. (*Maine.*)

Brackett, Col. G. B., Pomologist, Dept. of Agric., Washington, D. C. (*Hicoria. Hickory. Juglans.*)

Braunton, Ernest, Gardener, Los Angeles, Calif. (*Many valuable notes on plants cult. in Calif.*)

Breck & Sons, Joseph, Seedsmen, Boston, Mass. (*Portrait of Joseph Breck.*)

Budd, Prof. J. L., Horticultural author, Ames, Iowa. (*Iowa. Important fruits.*)

Budlong Bros., Pickle-makers, Providence, R. I. (*Cucumber. Martynia.*)

Burbank, Luther, Hybridist, Santa Rosa, Calif. (*Gladiolus.*)

Bush & Sons & Meissner, Bushberg, Mo. (*Grapes.*)

Caldwell, Geo. C., Prof. of Agric. Chemistry, Cornell Univ., Ithaca, N. Y. (*Fertility. Fertilizers. Lime.*)

Clark, Miss Josephine A., Asst. Librarian, Dept. of Agric., Washington, D. C. (*Information as to species after the date of Index Kewensis.*)

Clinton, L. A., Asst. Agriculturist, Cornell Exp. Sta., Ithaca, N. Y. (*Lime.*)

Coates, Leonard, Napa City, Calif. (*Fruit Culture in California.*)

Coville, Frederick V., Botanist, Dept. of Agric., Washington, D. C. (*Juniperus. Suggestions in various matters.*)

Cranefield, Fred, Asst. Horticulturist, Wis. Exp. Sta., Madison, Wis. (*Irrigation.*)

Dailledouze Bros., Wholesale florists, Flatbush, Brooklyn, N. Y. (*Mignonette.*)

Dandridge, Mrs. Danske, Amateur, Shepherdstown, W. Va. (*Hardy plants.*)

Davenport, Geo. E., Botanist, specialist in ferns, Medford, Mass. (*Several genera of ferns.*)

Day, Miss Mary A., Librarian, Gray Herbarium of Harvard Univ., Cambridge, Mass. (*Rare books.*)

Devron, Dr. G., Amateur in bamboos, New Orleans, La. (*Bamboo.*)

Dock, Miss M. L., Harrisburg, Pa. (*Bartram.*)

Downer's Sons, J. S., Fairport, Ky. (*Kentucky.*)

Dreer, H. A. (Inc.), Seedsmen and plantsmen, Philadelphia, Pa. (*Many and varied services, especially in aquatics, ferns, foliage plants and rare annuals.*)

Elliott, J. Wilkinson, Landscape architect, Pittsburg, Pa. (*Kochia, and some herbaceous perennials.*)

Ellwanger & Barry, Nurserymen, Rochester, N. Y. (*Hardy plants.*)

Fisher, Jabez, Fruit-grower, Fitchburg, Mass. (*Massachusetts.*)

Ganong, W. F., Prof. of Botany, Smith College, Northampton, Mass. (*Cacti.*)

Goodman, L. A., Fruit-grower, Westport, Mo. (*Missouri.*)

Halliday Bros., Florists, Baltimore, Md. (*Azalea. Camellia.*)

Harris, J. S., Fruit-grower, La Crescent, Minn. (*Minnesota.*)

Heiss, J. B., Florist, Dayton, Ohio. (*Palms.*)

Hutt, R. L., Prof. of Horticulture, Ont. Agric. College, Guelph, Ont. (*Kale. Kohlrabi.*)

Jones, Rev. C. J. K., Los Angeles, Calif. (*Various Californian plants.*)

Jordan, Dr. W. H., Dir., N. Y. Exp. Sta., Geneva, N. Y. (*Fertility. Fertilizers.*)

Kedzie, Dr. R. C., Prof. of Chemistry, Mich. Agric. College, Agricultural College, Mich. (*Fertility. Fertilizers. Lime.*)

*King, F. H., Prof. of Agricultural Physics, Madison, Wis. (*Irrigation, Mulching, etc.*)

Latham, A. W., Secretary Minn. Hort. Soc., Minneapolis, Minn. (*Minnesota.*)

Lupton, J. M., Market-gardener, Gregory, L. I. (*Cabbage.*)

Mackenzie, R. R., Manager bulb department, J. M. Thorburn & Co., New York, N. Y. (*Many important bulbs.*)

Makepeace, A. D., Cranberry-grower, West Barnstable, Mass. (*Cranberry.*)

Manda, W. A., Nurseryman, South Orange, N. J. (*Orchid pictures.*)

Manning, Jacob W., Nurseryman, Reading, Mass. (*Dried specimens of herbaceous perennial plants.*)

Manning, Robert, Sec. Mass. Hort. Soc., Boston, Mass. (*Biographical sketches. Horticulture.*)

May, John N., Florist, Summit, N. J. (*Florists' Flowers.*)

Meehan, Thos., Nurseryman, Germantown, Pa. (*The article "Horticulture."*)

Miller, E. S., Specialist in bulbs, Floral Park, L. I. (*Many articles on bulbs.*)

Mudge, W. S., Hartland, N. Y. (*Muskmelon.*)

Nanz & Neuner, Florists and seedsmen, Louisville, Ky. (*Kentucky.*)

Nash. Geo. V., Asst. N. Y. Bot. Garden, Bronx Park, N. Y. (*Genera of grasses.*)

Parsons, Samuel, Nurseryman, Flushing, L. I. (*The article "Horticulture."*)

Pendergast, W. W., Pres. Minn. Hort. Soc., Hutchinson, Minn. (*Minnesota.*)

Pierson, F. R., Nurseryman, Tarrytown-on-Hudson, N. Y. (*Bulbs.*)

Powell, Geo. T., Pomologist, Ghent, N. Y. (*Important fruits.*)

Ragan, W. H., Div. of Pomology, Dept. of Agric., Washington, D. C. (*Indiana.*)

Rider, Prof. A. J., Trenton, N. J. (*Cranberry.*)

Robinson, Dr. B. L., Curator Gray Herbarium of Harvard Univ., Cambridge, Mass. (*Various articles on native plants.*)

Robinson, John, Author of "Ferns in their Homes and Ours," Salem, Mass. (*Several articles on ferns.*)

Sander & Co. (A. Dimmock, Agent), New York, N. Y. (*Recent importations, particularly orchids and palms.*)

Schultheis, Anton, Nurseryman and florist, College Point, N. Y. (*Woody plants from Australia and the Cape, as Erica.*)

Scoon, C. K., Fruit-grower, Geneva, N. Y. (*Cherry.*)

Scribner, F. Lampson, Agrostologist, Dept. of Agric., Washington, D. C. (*Genera of grasses.*)

Sears, Prof. F. C., School of Horticulture, Wolfville, Nova Scotia. (*Canada.*)

Seavey, Mrs. **Fannie Copley**, Landscape gardener, Brighton, Ill. (*Landscape Gardening.*)

Shady Hill Nursery Co., Boston, Mass. (*Herbaceous perennials.*)

Shaw, Thos., Prof. of Agric., Univ. of Minn., Minneapolis, Minn. (*Medicago. Melilotus.*)

Slaymaker, A. W., Fruit-grower, Camden, Del. (*Delaware.*)

Smith, Irving C., Market-gardener, Green Bay, Wis. (*Kohlrabi.*)

Stanton, Geo., Ginseng specialist, Summit, N. J. (*Ginseng.*)

Storrs & Harrison, Nurserymen, Painesville, Ohio. (*Various plants.*)

Suzuki & Iida, Yokohama Nursery Co., New York, N. Y. (*Japanese plants.*)

Todd, Frederick G., Landscape architect, Montreal, P. Q. (*Hardy trees and shrubs.*)

Vick's Sons, James, Seedsmen, Rochester, N. Y. (*Various plants.*)

Ward, C. W., Wholesale florist and carnation specialist, Cottage Gardens, Queens, L. I. (*Carnation.*)

Webb, Prof. **Wesley**, Dover, Del. (*Delaware.*)

Wedge, Clarence, Fruit-grower, Albert Lea, Minn. (*Minnesota.*)

Wheeler, C. F., Prof. of Botany, Mich. Agric. College, Agricultural College, Mich. (*Hypericum. Mimulus.*)

White, J. J., Cranberry-grower, New Lisbon, N. J. (*Cranberry.*)

Willard, S. D., Nurseryman, Geneva, N. Y. (*Important fruits, as Cherry.*)

Wittbold, Geo., Florist, Chicago, Ill. (*Palms and ferns.*)

Wright, Charles, Horticulturist, Seaford, Del. (*Delaware.*)

Yeomans, L. T., Fruit-grower, Walworth, N. Y. (*Evaporation of fruits.*)

ABBREVIATIONS

I. OF GENERAL EXPRESSIONS

cult.	cultivated, etc.
diam.	diameter.
E.	east.
ft.	feet.
in.	inches
N.	north.
S.	south.
trop.	tropics, tropical.
W.	west.

II. OF BOTANICAL TERMS

fl.	flower.
fls.	flowers.
fld.	flowered.
fr.	fruit.
h.	height.
lf.	leaf.
lft.	leaflet.
lvs.	leaves.
st.	stem.
sts.	stems.
syn.	synonym.
var.	variety.

III. OF BOOKS AND PERIODICALS

To aid the student in the verification of the work, and to introduce him to the literature of the various subjects, citations are made to the portraits of plants in the leading periodicals to which the American is most likely to have access. These references to pictures have been verified as far as possible, both in the MS. and in the proof. A uniform method of citation is much to be desired, but is extremely difficult, because periodicals rarely agree in methods. With great reluctance it was decided to omit the year in most cases, because of the pressure for space, but the student who lacks access to the original volumes may generally ascertain the year by consulting the bibliographical notes below.

An arbitrary and brief method of citation has been chosen. At the outset it seemed best to indicate whether the cited picture is colored or not. This accounts for the two ways of citing certain publications containing both kinds of pictures, as The Garden, Revue Horticole, and Gartenflora. The figures given below explain the method of citation, and incidentally give some hints as to the number of volumes to date, and of the number of pages or plates in one of the latest volumes.

A few works of the greatest importance are mentioned elsewhere by way of acknowledgment (p. xv). The standard works on the bibliography of botany are Pritzel's Thesaurus and Jackson's Guide to the Literature of Botany; also, Jackson's Catalogue of the Library of the Royal Botanic Gardens, Kew.

A.F.	The American Florist. Chicago. A trade paper founded August 15, 1885. The volumes end with July. Many pictures repeated in "Gng." (14:1524=vol. and page.)
A.G.	American Gardening. New York. Represents 14 extinct horticultural periodicals, including The American Garden (1888–1890). Founded 1879(?) (20:896=vol. and page.)
B.	The Botanist. Edited by Maund. No years on title pages. Founded 1839. 8 vols., 50 colored plates in each vol. (8:400=vol. and col. plate.) Cumulative index.
B.B.	Britton & Brown. An illustrated Flora of the Northern U. S., etc. New York. 1896–1898. (3:588=vol. and page.)
B.F.	See F.
B.H.	La Belgique Horticole. Ghent. 35 vols. (1851–1885.)
B.M.	Curtis' Botanical Magazine. London. Founded 1787. The oldest current periodical devoted to garden plants. The vol. for 1899 is vol. 125 of the whole work. Index to first 107 volumes by E. Tonks. London. (7690=col. plate.)
B.R.	Botanical Register (1815–1847). Vols. 1–14 edited by Edwards: vols. 15–33 by Lindley. In vols. 1–23 the plates are numbered from 1–2014. In vols. 24–33 they are numbered independently in each vol. There are 688 plates in vols. 24–33. "An Appendix to the First Twenty-three Volumes" (bound separately or with the 25th vol.) contains an index to the first 23 vols. An index to vols. 24–31 may be found in vol. 31. (33:70=vol. and col. plate.)
D.	Dana. How to Know the Wild Flowers. New York. 1893. (298=page.)
Em.	Emerson, G. B. Trees and Shrubs of Massachusetts. Boston. 2 vols. 149 plates.
F.	The Florist. London. 1840–1884. (1884:192=year and page pp. col. plate.) Editors and title pages changed many times. Known as the Florist, Florist's Journal and Florist and Pomologist. Sometimes improperly called British Florist.
F.C.	Floral Cabinet. Knowles & Westcott. London. 1837–1840. (3:137 vol. and col. plate).

F.E.	The Florists' Exchange. New York. A trade paper, whose pictures sometimes are repeated in "A.G." Founded Dec. 8, 1888. (11:1298=vol. and page.)
F.J.	See F.
F.M.	Floral Magazine. London. Series I. 1861–1871, 8vo. Series II. 1872–1881, 4to. (1881:450=year and col. plate.)
F.P.	See F.
F.R.	Florists' Review. Chicago. A trade paper. Vol. 1, Dec. 2, 1897, to May 26, 1898. Two vols. a year. (4:660=vol. and page.)
F. S.	Flore des Serres. Ghent. (1845–1880.) Inconsistent in numbering, but the plate numbers are always found on the plate itself or on the page opposite. Valuable but perplexing indexes in vols. 15 and 19. (23:2481=vol. and col. plate.)
G. C.	The Gardeners' Chronicle. London. Series I. (1841–1873) is cited by year and page. Series II. or "New Series" (1874–1886), is cited thus: II. 26:824=series, volume and page. Series III. is cited thus: III. 26:416. Two vols. a year, beginning 1874. A select index is scattered through 1879 and 1880. Consult II. 12:viii (1879), and similar places in subsequent vols.
G. F.	Garden and Forest. New York. 1888–1897. (10:518=vol. and page.)
G.M.	Gardeners' Magazine. London. Ed. by Shirley Hibberd. Founded 1860. Vols. 31–42 are cited. (42:872=vol. and page.)
Gn.	The Garden. London. Founded 1871. Two vols. a year. (56:1254=vol. and col. plate. 56, p. 458=vol. and page containing black figure.) An Index of the first 20 vols. was separately published. Complete Index of Colored Plates to end of 1888 in vol. 54, p. 334.
Gng.	Gardening. Chicago. Founded Sept. 15, 1892. Vols. end Sept. 1. (7:384=vol. and page.)
Gt.	Gartenflora. Berlin. Founded 1852. (Gt. 48:1470=vol. and col. plate. Gt. 48, p. 670=vol. and page containing black figure.)
G.W.F.	Goodale's Wild Flowers of America. Boston, 1886. (50=col. plate.)
HBK.	Humboldt, Bonpland & Kunth. Nova Genera et Species, etc. Paris. 1815–25. 7 vols. Folio.
I. H.	L'Illustration Horticole. Ghent. (1854–1896.) (43:72=vol. and col. plate.) The volumes were numbered continuously, but there were 6 series. Series I.=1854–63. Series II.=1864–69. Series III.=1870–80. Series IV.=1881–86. Series V.=1887–93. Series VI.=1894–96. The plates were numbered continuously in the first 16 vols. from 1 to 614: in vols. 17–33 they run from 1 to 619: in series V. from 1 to 190: in Series VI. they begin anew with each vol. Valuable indexes in vols. 10 and 20. Series V. in 4to, the rest 8vo.
J.H.	Journal of Horticulture. London. Founded in 1848 as The Cottage Gardener. Series III. only is cited, beginning 1880. (III. 39:504=series, vol., page.)
K.W.	See F. C.
L.	In vol. 1 of this work, sometimes means Lindenia, sometimes Lowe's Beautiful Leaved Plants. See "Lind." and "Lowe."
L.B.C.	The Botanical Cabinet. Loddiges. 1817–33. 100 plates in each vol. Complete index in last vol. (20:2000=vol. and col. plate.)
Lind.	Lindenia, Ghent. Founded 1885. Folio. Devoted to orchids.
Lowe	Beautiful Leaved Plants. E. J. Lowe and Howard. London. 1864. (60=col. plate.)
M.	A. B. Freeman-Mitford. The Bamboo Garden. London. 1896. (224=page.)
M.D.G.	Möller's Deutsche Gärtner-Zeitung. Erfurt. Founded 1886. (1897:425=year and page.)
Mn.	Meehan's Monthly. Germantown, Philadelphia. Founded 1891. (9:192=vol. and page opposite col. plate.)
N.	Nicholson. Dictionary of Gardening. Vols. 1–4 (1884–1887). Vol. 5 in preparation.
P.F.G.	Lindley & Paxton. Flower Garden. London. 1851–53. 3 vols. 4to.
P.G.	Popular Gardening. Buffalo. 1885–90. (5:270=vol. and page.)
P.M.	Paxton's Magazine of Botany. London. 1834–49. (16:376=vol. and page opposite col. plate.) Vol. 15 has index of first 15 vols.
R.	Reichenbachia. Ed. by Fred. Sander. London. Founded 1886. Folio.
R.B.	Revue de l'Horticulture Belge et Etrangère Ghent. Founded 1875? (23:288=vol. and page opposite col. plate.) In the first vol. of the CYCLOPEDIA "R.B." sometimes means Belgique Horticole, but the confusion is corrected in later vols., where Belgique Horticole is abbreviated to "B.H."
R.H.	Revue Horticole. Dates from 1826, but is now considered to have been founded in 1829. (1899:596=year and page opposite col. plate. 1899, p. 596=year and page opposite black figure.)
S.	Schneider. The Book of Choice Ferns. London. In 3 vols. Vol. 1, 1892. Vol. 2, 1893.
S.B.F.G.	Sweet British Flower Garden. London. Series I., 1823–29, 3 vols. Series II., 1831–38, 4 vols.
S.H.	Semaine Horticole. Ghent. Founded 1897. (3:548=year and page.)
S.M.	Semaine Horticole. Erroneously cited in this fashion a few times in first vol.
S.S.	Sargent. The Silva of North America. 13 vols. Vol. 1, 1891. Vol. 12, 1898. (12:620=vol. and plate, not colored.)
S.Z.	Siebold & Zuccarini. Flora Japonica. Vol. 1, 1835–44. Vol. 2 by Miquel, 1870. (2:150=vol. and plate.)
V. or V. M.	Vick's Magazine. Rochester, N. Y. Founded 1878. Vols. numbered continuously through the 3 series. Vols. begin with Nov. (23:250=vol. and page.) Sometimes cited as "Vick."

⁂ *Additional abbreviations and explanations will be found in the introductory pages of Vol. I.*

Cyclopedia of American Horticulture

EARTH NUT, EARTH PEA. English names for the Peanut, or Goober, *Arachis hypogœa.* Also *Apios.*

EATÒNIA (Amos Eaton, American botanist, 1776–1842; author of popular Manual of Botany of the United States, which was for a long time the only general work available for American students). *Gramineœ.* A North American genus of 4 or 5 species of tufted perennial grasses. Three kinds have been catalogued by Wilfred Brotherton, Rochester, Mich.

A. *Panicle dense, spike-like, strict.*

obtusàta, Gray. Spikelets crowded on the short, erect panicle-branches: upper empty glume rounded-obovate, very obtuse. Dry soil.

AA. *Panicle more loose and slender.*

Pennsylvánica, Gray. Lvs. 3–6 in. long: panicle-branches lax, nodding. Moist woods and meadows.

Dúdleyi, Vasey. Lvs. 1–2 in. long: panicle-branches spreading in flowering time, afterwards erect.

A. S. Hitchcock.

EBONY. *Diospyros Ebenus.*

ECBÁLLIUM (Greek, *to throw out*). *Cucurbitàceœ.* Squirting Cucumber. The Squirting Cucumber is one of the most amusing and disconcerting of all plants. Few if any cultivated plants fire their seeds at one with such startling suddenness and force. It is a hardy annual trailing vine, easily grown in any garden. When ripe, the oblong, prickly fruit squirts its seeds at the slightest touch, or sometimes at the mere vibration of the ground made by a person walking by. The boy or girl who did not like this plant never lived. Some of the old herbalists called this plant *Cucumis asininus.* Another curious fact about the plant is that a powerful cathartic is made from the juice of the fruit, which has been known for many centuries. A preparation of it is still sold in the drug stores as *Trituratio Elaterini.* Ecballium has only one species, and is closely related to the important genera Cucumis and Citrullus. With them it differs from Momordica in lacking the 2 or 3 scales which close the bottom of the calyx. Other generic characters are: prostrate herb, fleshy, rough hairy: lvs. heart-shaped, more or less 3-lobed: tendrils wanting: fls. yellow, the staminate in racemes, pistillate usually from the same axils with the staminate fls.; calyx 5-cut. It is a native of the middle and eastern Mediterranean regions, especially rich, moist forests. Sims, in the Botanical Magazine, says the plant "is generally considered as an annual, but if the soil is dry and the situation sheltered, the root will survive two or three winters, and the plants will flower earlier and spread farther than those of the same year."

Elatèrium, A. Rich. (*Momórdica Elatèrium,* Linn.). Squirting Cucumber. Fig. 744. Described above. B.M. 1914.

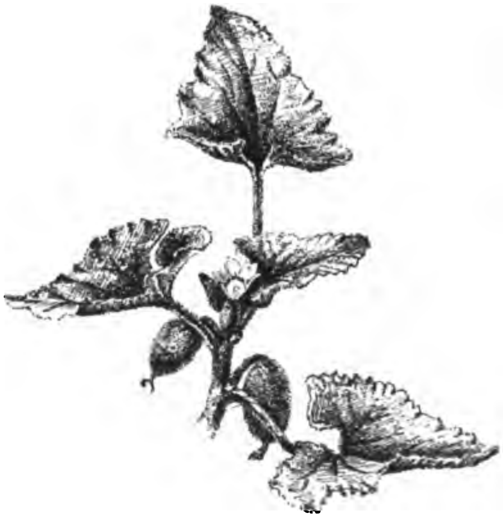
W. M.

ECCREMOCÁRPUS (Greek, *pendent fruits*). *Bignoniàceœ.* Three to five species of tall, somewhat woody plants from Peru and Chile, climbing by branched tendrils at the end of the twice pinnate leaves, and having very distinct flowers of somewhat tubular shape, which are colored yellow, orange or scarlet. The species mentioned below is doubtless perennial in southern California, where it is said to show best when climbing over shrubbery, but in the East it is treated as a tender annual and is perhaps usually trained to a trellis or south wall. It bears flowers and fruits at the same time, and the orange flowers make an effective contrast with the pale green foliage. The genus belongs to an order famous for its superb tropical climbers, but in its own tribe only two genera have any horticultural fame, and that small. These are Jacaranda and Colea, having a 2-celled ovary, while that of Eccremocarpus is 1-celled. Eccremocarpus has two sections, in one of which the corollas are cylindrical, but in the section Calampelis, to which *E. scaber* belongs, the corolla has a joint at a short distance beyond the calyx, then swells out on the under side, and suddenly constricts into a neck before it reaches the small, circular mouth, surrounded by 5 short, rounded lobes.

scàber, Ruiz & Pav. (*Calámpelis scàber,* D. Don). Although the specific name means rough, the wild plant is only sparingly puberulous, and in cultivation entirely glabrous. About 10 ft. high: lvs. bipinnate; lfts. obliquely cordate, entire or saw-toothed: fls. 1 in. long, orange, in racemes. July, Aug. Chile. B.R. 11:939.

Peter Henderson & Co.

ECHEVÈRIA. All referred to *Cotyledon.*



744. Ecballium Elaterium (× ⅓).

ECHINÀCEA (Greek, *echinos,* hedgehog; alluding to the sharp-pointed bracts of the receptacle). *Compósitœ.* Purple Cone-flower. Four species of North American perennial herbs, two of them from Mexico, the others native to the United States, and cultivated in our hardy borders. They are closely related to Rudbeckia, but their rays range from flesh color, through rose, to purple and crimson, while those of Rudbeckia are yellow or partly (rarely wholly) brown-purple. The high disk and the downward angle at which the rays are pointed are charming features of Echinaceas. The disk is only convex at first, but becomes egg-shaped, and the receptacle conical, while Rudbeckia has a greater range, the disk from globose to columnar, and the receptacle from conical to cylindrical. Echinaceas and Rudbeckias are stout, and perhaps a little coarse in appearance, but their flowers, sometimes 6 in. across, are very attractive, and borne in succession for two months or more of late summer. With the growing appreciation o hardy borders and of native plants, it should be possible to procure 4 or 5 distinct colors in the flower, associated with low, medium and tall-growing habits. They do well in ordinary soils, and may be used to help cover unusually dry and exposed spots. They respond well to rich soil, especially sandy loam, and prefer warm and sunny sites. They are perennials of easy culture. Prop. by division, though not too frequently; sometimes by seeds. The roots are black, pungent-tasted, and are said to be used in popular medicine under the name of Black Sampson. Bentham & Hooker refer Echinacea to Rudbeckia.

purpùrea, Mœnch. Commonly not hairy, typically taller than *E. angustifolia*, 2 ft. or more high: lvs. ovate-lanceolate, or the lower ones broadly ovate, often 5-nerved, commonly denticulate or sharply serrate, most of them abruptly contracted into a margined petiole: rays at first an inch long and broadish, later often 2 in. long or more, with the same color range as *E. angustifolia*, but rarely almost white. Rich or deep soil. Va. and Ohio to Ill. and La.

Var. **serótina,** Nutt. (*E. intermèdia*, Lindl.). The varietal name means late-flowering, but the chief point is the hairy or bristly character of the plant. L.B.C. 16:1539. P.M. 15:79.—J. B. Keller says "this is, perhaps, the best form of the genus for garden purposes, the rays being much brighter colored, broader and not rolling at the edges."

angustifòlia, DC. Bristly, either sparsely or densely: lvs. narrower than in *E. purpurea*, from broadly lanceolate to nearly linear, entire, 3-nerved, all narrowed gradually to the base, the lower into slender petioles: flower-heads nearly as large as in *E. purpurea*, but sometimes much smaller. Prairies and barrens, Saskatchewan and Neb. to Tex., east to Ill., Tenn. and Ala. B.M. 5281. G.W.F. 25.—This species has several forms, which approach and run into *E. purpurea*. L. H. B.

ECHINOCÁCTUS (Greek, *spine* and *cactus*). *Cactàceæ*. A very large genus of globular, strongly ribbed, and strongly spiny forms. Sometimes they become very short-cylindrical; occasionally the ribs are broken up into tubercles which resemble those of Mammillaria; and rarely spines are entirely wanting. The flowers usually appear just above the young spine-bearing areas, but sometimes they are further removed, and occasionally they are in the axil of a tubercle. The ovary bears scales which are naked or woolly in the axils, and the fruit is either succulent or dry. The genus is well developed within the United States, about forty species having been recognized, but its extreme northern limit is the southern borders of Colorado, Utah, and Nevada, apparently having spread from the great arid plateau regions of Mexico proper and Lower California. The genus extends throughout Mexico and Central America, and is well represented in the drier regions of South America. The genera Astrophytum and Lophophora are here included, although they seem to be very different from the typical forms of Echinocactus. It is impossible to identify with certainty all of the specific names found in trade catalogues, but the following synopsis contains the great majority of them. In all cases the original descriptions have been consulted, and in some cases it is certain that a name originally applied to one form has been shifted to another. The following synopsis may be useful, therefore, in checking up the proper application of names, but it may thus leave some of the common species of the trade unaccounted for. No attempt is made to group the species according to relationships, but a more easily handled artificial arrangement, based chiefly upon spine characters, is used It must be remembered that the species are exceedingly variable, especially under cultivation, and large allowance must be made for the characters given in the key and in the specific descriptions.

Echinocactus Poselgerianus, A. Dietr., proves to be *Mammillaria Scheerii*. The following horticultural names have not been identified: *E. chrysanthus* (*chrysacanthus ?*), *Dræganus trifurcatus*.

JOHN M. COULTER.

When starting with newly collected plants of Echinocactus the mutilated roots should be well cut back to within an inch or two of the base of the plants. If the plants are procured in early summer, the best way to get new roots on them is to place the plants on a bench of a greenhouse with a southern exposure, in a mound of fine gravel about eight or ten inches deep. Insert the base of the plants in the gravel and syringe them overhead once a day on bright days. The gravel gets very hot with the sun, and in this they root freely in three or four weeks. When well rooted they can be placed in pots. A good compost consists of six parts of good fibrous loam, one part sand and one part brick rubble. Pots should be just large enough to hold the plants and should be drained about one-fifth of their depth. From March to May is a good time to pot established plants, but if the soil is good and the drainage all right they can remain in the same pots for two or three years.

The plants should receive all the sunlight possible at all times of the year. During the winter they should be watered very sparingly, but in spring and summer they can be watered freely and syringed overhead on bright days. In winter Echinocactus require a night temperature of from 45° to 50° Fahr., and the atmosphere should be perfectly dry. Propagation is effected by seeds, cuttings and grafting. ROBERT CAMERON.

The diversity of form exhibited in the genus Echinocactus since the genera Astrophytum and Lophophora are now included, makes this one of the most interesting of the whole Cactus family. Unlike most globular forms of Cacti, they do not readily produce offsets; consequently they must be propagated by seeds if one wishes to increase these plants in quantity. Seeds of Echinocactus, and, in fact, most cactaceous plants, will germinate as freely as seeds of other plants, provided they have been allowed to ripen properly before gathering and carefully dried afterwards. From the experience of the writer, who has raised some hundreds of seedling Cacti and sown them every month in the year, he has found the months of May and June to be by far the most favorable for germination. Seeds of Echinocactus will then germinate in five or six days, while during the winter months it takes almost as many weeks. Opuntias will germinate in even less than six days. They germinate most readily of all the Cactaceæ, and grow the fastest afterwards, while Mammillarias are the slowest to germinate and grow the slowest afterwards. The seeds should be sown in well-drained 4-inch pots in a finely sifted mixture of one part leaf-mold, one part loam and one part charcoal dust and silver sand. The surface should be made very smooth, and the seeds pressed lightly into the soil with the bottom of a flower-pot and then covered with about three-eighths of an inch of fine silver sand. This allows the seedlings to push through readily and prevents the soil from crusting on the surface of the pots, as they usually have to stay in their seedling pots at least one year. The pots should be placed in a greenhouse where they will receive plenty of light but not the direct sunlight, for, although Cacti are natives of desert regions, the writer has found from experience that the seedlings will simply roast if exposed to full sunlight under glass. For the first winter, at least, the seedlings should be kept in a temperature of not less than 60° and carefully looked over every day to ascertain the condition of the soil, for, although they should be kept on the dry side, they must never be allowed to become quite dry during the seedling stage. When about a year old they may be transplanted to shallow pans not more than 6 inches in diameter, and prepared with the same mixture as for seedling pots. These pans will be found better than small pots, because the soil may be kept more evenly moist and the seedlings do better in consequence.

When grown from 2 to 3 inches in diameter, seedling Echinocactus may be transferred to pots, using sizes only just large enough to accommodate them, as they make but few roots. Pot them in a mixture of two parts fibrous loam, one part leaf-mold and one part pounded brick and silver sand. During the spring and summer months, established plants may be given a liberal supply of water, but must be studiously watered during the fall and winter months. During the winter they should be given a light position in a dry greenhouse, with a night temperature of 45° to 50°, and a rise of 10° by day. For the summer, they may be either kept in an airy greenhouse or placed in some convenient position outside, plunging the pots in the soil or in some light non-conducting material. Some of the species will commence to blossom in May and others at intervals during the summer. The flowers vary considerably in size, and embrace a good range of color, from white to deep yellow, and from the faintest purple to deep rose. They do not readily produce seed (in New England, at least) unless artificially fertilized. Like most of the Cactus family, the more cylindrical species will readily unite when grafted upon other kinds, not only in the same genus, but in other genera of Cactaceæ, and for weak-growing species it may often be an advantage to graft upon some stronger-growing species. *Cereus Baumanni* (or *C. colubrinus*) makes an excellent stock to graft upon, choosing stock plants of reasonable size and height. The system known as "wedge-grafting" is perhaps best for the purpose, and the early spring months, or just as the growing season is about to commence, is the best time for grafting.

If plants of Echinocactus can be kept in a healthy condition, they are not much troubled with insect pests; mealy-bug is their worst enemy and should be removed at once with a clean mucilage brush. As a guide to amateurs, the writer has found the following to be among the most easily grown: *Echinocactus capricornis, E. coptonogonus, E. cornigerus, E. Grusoni, E. horizonthalonius, E. longihamatus, E. myriostigma, E. setispinus, E. Texensis, E. Williamsii* and *E. Wislizeni*

EDWARD J. CANNING.

INDEX.

Anhalonium, 51.
arrigens, 30.
Astrophytum, 50.
bicolor, 35.
brevihamatus, 5.
capricornis, 15.
coptonogonus, 13.
cornigerus, 9.
crispatus, 30.
cylindraceus, 2.
Echidne, 23
electracanthus, 22.
Emoryi, 25.
flavovirens, 36.
Grusoni, 44.
helophorus, 28.
hexædrophorus, 31.
horizonthalonius, 21.
ingens, 20.
intertextus, 37.
Johnsoni, 39.
Lecontei, 42.
leucacanthus, 18.
Lewinii, 52.
longihamatus, 3.
Lophophora, 51.
lophothele, 32.
micromeris: see *Mammillaria*.
Mirbelli, 19.
Monvillii, 11.
multicostatus, 14.
myriostigma, 50.
obvallatus, 29.
Orcuttii, 38.
ornatus, 19.
orthacanthus, 36.
Ottonis, 34.
Pfeifferi, 12.
phyllacanthus, 17.
pilosus, 47.
polycephalus, 40.
polyancistrus, 10.
recurvus, 26.
Rinconensis, 16.
robustus, 33.
Saltillensis, 45.
Scopa, 46.
setispinus, 27.
Sileri, 43.
Simpsoni, 48.
sinuatus, 6.
Texensis, 24.
Treculianus, 6.
turbiniformis, 49.
uncinatus, 1, 7.
Vanderæyi, 23.
viridescens, 41.
Visnaga, 20.
Whipplei, 8.
Williamsii, 51.
Wislizeni, 4.
Wrightii, 1.

A. *Spines, or some of them, hooked.*

B. *Central spine solitary.*

1. **Wrightii** (*E. uncinàtus*, var. *Wrightii*, Engelm.). Oval, 3–6 in. high, 2–3½ in. in diam.: radial spines 8, arranged as in uncinatus; central spine solitary, angled, flexuous and hooked, elongated (2–6 in.), erect, straw-color, with dark tip: flowers 1–1½ in. long, dark purple. Texas and northern Mexico.

BB. *Central spines 4.*

C. *Some or all of the spines annulate.*

2. **cylindràceus**, Engelm. Globose to ovate or ovate-cylindrical, simple or branching at base, becoming as much as 3 ft. high and 1 ft. in diam.: ribs 13 in younger specimens, 20–27 in older ones, obtuse and tuberculate: spines stout, compressed, more or less curved, reddish; radials about 12, with 3–5 additional slender ones at upper edge of areola, 1–2 in. long, the lowest stouter and shorter and much hooked; centrals 4, very stout and 4-angled, about 2 in. long and one-twelfth to ⅛ in. broad, the uppermost broadest and almost straight and erect, the lowest decurved: flowers yellow. Southwestern United States and Lower California.

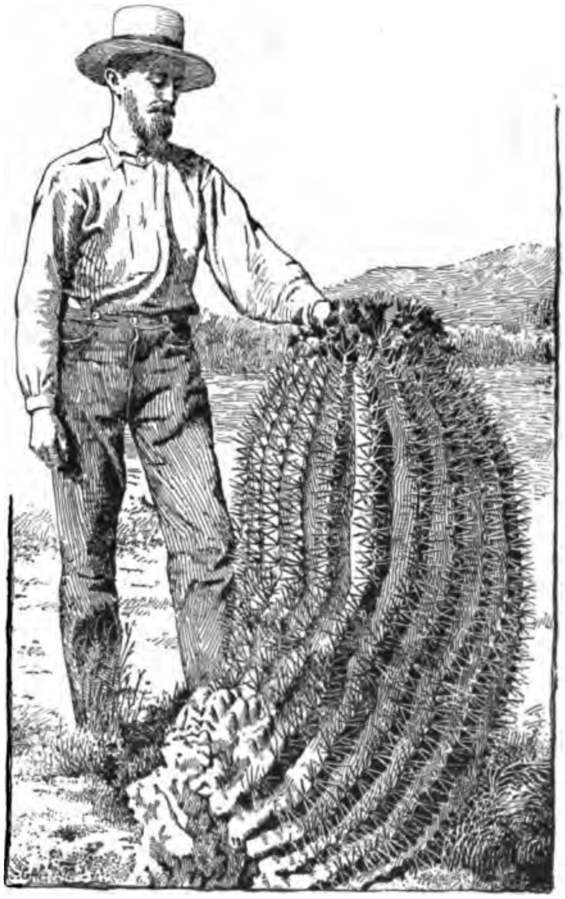
3. **longihamàtus**, Gal. Subglobose or at length ovate, becoming 1–2 ft. high: ribs 13–17, often oblique, broad, obtuse, tuberculate-interrupted: spines robust, purplish or variegated when young, at length ashy; radials 8–11, spreading, straight or curved or flexuous, the upper and lower ones 1–3 in. long, the laterals 2–4 in.; centrals 4, angled, the upper ones turned upwards, straight or curved or twisted, the lower one stouter, elongated (3–8 in.), flexuous and more or less hooked: flowers yellow, tinged with red, 2½–3½ in. long. Texas and Mexico.

4. **Wislizeni**, Engelm. At first globose, then ovate to cylindrical, 1⅗–4 ft. high: ribs 21–25 (13 in small specimens), acute and oblique, more or less tuberculate: radial spines three-fifths to 2 in. long, the 3 upper and 3–5 lower ones stiff, straight or curved, annulate, red (in old specimens the 3 stout upper radials move toward the center and become surrounded by the upper bristly ones), the 12–20 laterals (sometimes additional shorter ones above) bristly, elongated, flexuous, horizontally spreading, yellowish white; centrals 4, stout, angled, and red, one and three-fifths to three and one-fifth in. long, the 3 upper straight, the lower one longest (sometimes as much as 4–5 in.), very robust (flat and channeled above), hooked downward: flowers yellow or sometimes red, two to two and three-fifths in. long. From southern Utah to northern Mexico and Lower California.

CC. *None of the spines annulate.*

5. **brevihamàtus**, Engelm. Globose-ovate, very dark green: ribs 13, deeply tuberculate-interrupted, the tubercles with a woolly groove extending to the base: radial spines mostly 12, terete, straight, white or yellowish, with dusky tips, ½–1 in. long, the upper longer; central spines 4 (rarely 1 or 2 additional ones), flattened, white with black tips, the 2 lateral ones divergent upward, straight or a little recurved, 1–2 in. long, the uppermost one weaker, the lower stoutest and darkest, porrect or deflexed, hooked downward, ¾–1 in. long: flowers funnelform, rose-color, 1–1½ in. long. Southwestern Texas and New Mexico.

6. **sinuàtus**, Dietr. (*E. Treculiànus*, Labour.). Globose, 4–8 in. in diam., bright green: ribs 13, oblique, acute, tuberculate-interrupted, the tubercles short-grooved: radial spines 8–12, setiform and flexible, the



745. Echinocactus Emoryi, var. rectispinus.

3 upper and 3 lower purplish brown and straightish (the lower ones sometimes more or less hooked), four-fifths to 1 in. long, the 2–6 laterals more slender, longer (1 to one and two-fifths in.), often flattened, puberulent and whitish, sometimes flexuous or hooked; central spines 4, puberulent, yellowish (or purplish variegated), the 3 upper ones slender, flattened or subangled, erect and generally straight (rarely hooked), one and three-fifths to 2 in. long, the lowest one much stouter, flattened or even channeled, straw-color, flexuous, more or less hooked (sometimes straight), 2–4 in. long: flowers yellow, 2–3 in. long. Texas, Arizona, and northern Mexico.

7. **uncinàtus**, Gal. Glaucescent, globose to oblong: ribs 13, obtuse, tuberculate-interrupted: radial spines 7 or 8, 1–2 in. long, the upper 4 or 5 straw-color, straight, flattened, the lower 3 purplish, terete and hooked; centrals 4, the upper 3 rather stout and straight, about 1 in. long, the lowest one very long, flattened, hooked at apex: flowers brownish purple. Northern Mexico.

8. **Whipplei**, Engelm. Globose-ovate, 3–5 in. high, 2–4 in. in diam.: ribs 13–15 (often oblique), compressed and tuberculately interrupted: radial spines usually 7, compressed, straight or slightly recurved, ½ to three-fifths in. long, lower ones shorter than the others, all white excepting the two darker lowest laterals; central spines 4, widely divergent, the uppermost one flattened, straight and white, 1 to one and three-fifths in. long, turned upward in the plane of the radials (completing the circle of radials), the others a little shorter, quadrangular-compressed, dark brown or black, becoming reddish and finally ashy, the 2 laterals straight, the lowest one stouter and sharply hooked downward: flower greenish red. Northern Arizona.

BBB. *Central spines 5 to 8.*

9. **cornígerus**, DC. Globose or depressed-globose, 10–16 in. in diam.: ribs about 21, very acute and wavy (not tuberculately interrupted): radial spines 6–10, white and comparatively slender, or wanting; centrals red and very robust, angular-compressed, with long, sharp, horny tips, the upper 3 erect-spreading, 1–1½ in. long, the lower 2 weaker and declined, the central one longer, more rigid and keeled, very broad (one-fifth to one-third in.) and hooked downward: flowers purple, 1–1½ in. long. Mexico and Central America.

10. **polyancístrus**, Engelm. & Bigel. Ovate or at length subcylindric, becoming 4–10 in. high and 3–4 in. in diam.: ribs 13–17, obtuse, tuberculately interrupted; radial spines 20 or more, compressed and white, the uppermost wanting, the 4 upper ones broader and longer (1–2 in.) and dusky-tipped, the laterals shorter (four-fifths to one in.), the lowest very short (½ in.) and subsetaceous; central spines of several forms, the uppermost one (rarely a second similar but smaller one above or beside it) compressed-quadrangular, elongated (3–5 in.), white with dusky tip, curved upward, the other 5–10 teretish or subangled, bright purple-brown; upper ones long (2–4 in.) and mostly straight, the others gradually shortening (to about 1 in.) downward and sharply hooked: flowers red or yellow, 2 to two and two-fifths in. long and wide. Nevada and southeastern California.

AA. *Spines not hooked.*

B. *Central spines none or indistinct.*

11. **Monvillii**, Lem. Stout, globose and bright green: ribs 13–17, tuberculate, broadest toward the base, undulate; tubercles somewhat hexagonal, strongly dilated below: radial spines 9–12, the lower ones somewhat longer, very stout, spreading, yellowish translucent, reddish at base; central wanting: flowers varying from white to yellow and red. Paraguay.

12. **Pfeifferi**, Zucc. Oblong-globose, becoming 1–2 ft. high and 1 ft. in diam.: ribs 11–13, compressed and somewhat acute: spines 6, about equal, rigid, straight, divergent or erect, pale transparent yellow with a brownish base; very rarely a solitary central spine. Mexico.

13. **coptonógonus**, Lem., var. **màjor**, Salm-Dyck. Depressed, from a large indurated naked napiform base, 2–4 in. across the top: ribs 10–15, acute from a broad base, more or less transversely interrupted and sinuous: spines 3, annulate, very stout and erect from deeply sunken areolæ, reddish when young, becoming ashy gray; upper spine stoutest, erect and straight, or slightly curved upward, flattened and keeled, and occasionally twisted, 1½–2¼ in. long; the two laterals erect-divergent, straight or slightly curved, terete above and somewhat quadrangular below, 1–1½ in. long; all from an abruptly enlarged base: flowers not seen, but said to be small and white, with purplish median lines. Mexico.

14. **multicostàtus**, Hildmann. Depressed-globose: ribs very numerous, 90 to 120, compressed into thin plates which run vertically or are twisted in every direction: spines exceedingly variable, in some cases wanting entirely, in others 3 or 4, short, rigid, and translucent yellow; in others more numerous, larger, and often flattish; in still other cases very long and flat, interlacing all over the plant; no centrals: flower white, with a broad purple stripe.

15. **capricórnis**, A. Dietr. Globose: ribs about 11, broad, spotted all over with white dots: clusters of spines distant, usually seen only near the apex; spines 5–10, long and flexuous; centrals not distinct: flowers large, yellow. Mexico.

16. **Rinconénsis**, Poselg. Cylindrical, covered with ivory white spines which are tipped with crimson: spines 3, with no centrals: flower large, purple-crimson, darker at base. Northern Mexico.

17. **phyllacánthus**, Mart. From globose to cylindrical, with depressed vertex, simple or proliferous, two and one-third to three and three-fifths in. broad: ribs 40–55 (sometimes as few as 30), very much crowded and compressed, thin, acute, very wavy, continuous or somewhat interrupted: radial spines 5 (sometimes 6 or 7), straight and spreading, the 2 lowest ones white, rigid, one-sixth to one-fourth in. long, half as long as the 2 darker, angled, larger laterals, the uppermost spine thin and broad, channeled above, faintly annulate, flexible, grayish pink, three-fifths to 1 in. long; central spines none: flowers small, dirty white. Mexico.

BB. *Central spine solitary (sometimes 2–4 in E. crispatus, helophorus, and setispinus, or wanting in lophothele).*

C. *Ribs less than 13.*

18. **leucacánthus**, Zucc. Somewhat clavate-cylindrical, pale: ribs 8–10, thick, obtuse, strongly tuberculate, the areolæ with strong wool: radial spines 7 or 8, similar, straight, finely pubescent, at first yellowish, at length white; central spine solitary, more or less erect, rarely wanting: flowers light yellow. Mexico.

19. **ornàtus**, DC. (*E. Mirbélli*, Lem.). Subglobose: ribs 8, broad, compressed, vertical, thickly covered with close-set white woolly spots, making the whole plant almost white: radial spines 7, straight, stout, yellowish or becoming gray; central spine solitary. Mexico.

20. **ingens**, Zucc. (*E. Visnàga*, Hook.). Very large (sometimes as much as 10 ft. high and as much in circumference), globose or oblong, purplish toward the top: ribs 8, obtuse, tuberculate: areolæ large, distant, with very copious yellowish wool: radial spines 8 or more; central spine solitary; all the spines shaded yellow and red or brownish, straight, rigid, and interwoven: flowers bright yellow, about 3 in. broad. Mexico.

21. **horizonthalònius**, Lem. Glaucous, depressed-globose or at length ovate or even cylindric with age, 2–8 in. high, 2½–4 in. in diam.: ribs 8–10 (fewer in very young specimens), often spirally arranged, the tubercles scarcely distinct by inconspicuous transverse grooves: spines 6–9, stout, compressed, reddish (at length ashy), recurved or sometimes almost straight, nearly equal, four-fifths to 1½ in. long (sometimes long and slender and almost terete, sometimes short, stout and broad); radials 5–8, upper ones weaker, lowest wanting; a single stouter decurved central (sometimes wanting): flowers pale rose-purple, 2½ in. long or more. New Mexico and northern Mexico.

CC. *Ribs 13-27.*

22. **electracánthus**, Lem. Globose or thick cylindrical, becoming 2 ft. high and 1 ft. in diam.: ribs about 15: radial spines about 8, equal, rigid, spreading, yellowish, about 1 in. long; the central one solitary, red at base: flowers clear yellow. Mexico.

23. **Echidne**, DC. (*E. Vanderœyi*, Lem.). Depressed-globose, 5–7 in. in diam., 3–4 in. high: ribs 13, acute: radial spines 7, broad, rigid, spreading, yellowish, 1 in. or more long; central spine solitary and scarcely longer than the others: flowers bright yellow, 1 in. or more long. Mexico.

24. **Texénsis**, Hopf. Mostly depressed (sometimes globose), 8–12 in. in diam., 4–6 in. high, simple: ribs mostly 21 (sometimes 27, and in smaller specimens 13 or 14) and undulate: spines stout and fasciculate, reddish, compressed; the exterior 6 or 7 radiant, straightish or curved, unequal, ½ to four-fifths in. long in some cases, one and one-fifth to 2 in. in others, much shorter than the solitary and stout recurved central, which is sometimes one-sixth to ¼ in. broad: flowers about one-fifth in. long, parti-colored (scarlet and orange below to white above). Texas and northeastern Mexico.

25. **Émoryi**, Engelm., var. **rectispinus**, Engelm. Fig. 745. Globose, at length cylindrical: ribs 13–21, obtuse and strongly tuberculate: radial spines 7–9, very unequal, the 3 upper ones 4–5 in. long, the lower 1½–3 in. long and paler; the central very long (12–13 in.), straight or slightly decurved. Southwestern United States and northern Mexico.

26. **recúrvus**, Link & Otto. Subglobose and very stout: ribs about 15, covered with broad, dark red spines, the radials spreading, the central one recurved and very stout. Mexico (?).

27. **setispinus**, Engelm. Subglobose, 2 to three and one-fifth in. in diam.: ribs 13, more or less oblique, often undulate or somewhat interrupted: radial spines 14–16, setiform and flexible, two-fifths to four-fifths in. long, the uppermost (the longest) and lowest ones yellowish brown, the laterals white; central spines 1–3, setiform and flexuous, dark, 1 to one and one-fifth in. long: flowers funnelform, one and three-fifths to 3 in. long, yellow, scarlet within. Texas and Mexico.

28. **helóphorus**, Lem. Depressed globose, light green, with purple-red veins: ribs about 20, compressed, obtuse: radial spines 9–12, very stout and porrect; central spines 1–4, stronger and annulate; all the spines pearl-gray. Mexico.

CCC. *Ribs 30 or more.*

29. **obvallàtus**, DC. Obovate-globose, depressed: ribs very numerous, vertical: spines most abundant towards the apex, unequal, spreading, stout, whitish; the 3 upper radials and solitary central strong, the others (especially the lowest) small: flowers purple, with whitish margin. Mexico.—The name was suggestod by the appearance of the terminal cluster of flowers surrounded by a fortification of strong spines.

30. **crispàtus**, DC. (*E. árrigens*, Link). Globose, 5 in. or more high: ribs 30–60, compressed and sharp, more or less undulate-crisped: spines 7–11, widely spreading, more or less flattened, the upper larger and brown at tip, the lower shorter and white, or all of them brown: flowers purple, or white with purple stripes. Mexico and Central America.

CCCC. *Tuberculate, as in Mammillaria.*

31. **hexædróphorus**, Lem. More or less globular, dark gray: ribs deeply tuberculate, giving the appearance of a Mammillaria, with hexagonal tubercles: radial spines 6 or 7, radiating like a star; central spine solitary, erect, longer; all the spines annulate, reddish brown: flowers white, tinted with rose. Mexico.

32. **lopothèle**, Salm-Dyck. Globose, strongly tuberculate, after the manner of Mammillaria: tubercles quadrangular, bearing clusters of 5–10, more or less porrect, long, rigid, and equal spines; central solitary or wanting: flowers white or yellowish. Mexico.

BBB. *Central spines 4 (2 or 3 in Sileri and sometimes 3 in Scopa).*

C. *Ribs less than 13.*

33. **robústus**, Otto. Clavate and stout: ribs about 8, compressed, vertical· radial spines about 14, the upper ones slender, the lowest 3 stronger; central spines 4, 4-angled at base, transversely striate, the lowest one largest; all the spines purple-red, 1½–3 in. long: flowers golden yellow. Mexico.

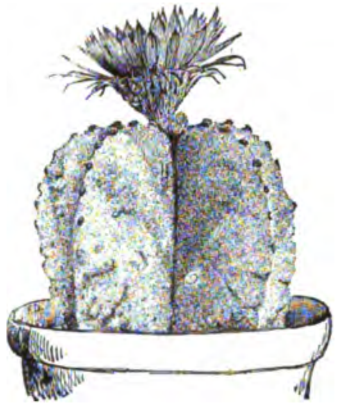
34. **Ottònis**, Link & Otto. Depressed-globose or ovate, 3–4 in. high: ribs 10–12, obtuse: radial spines 10–18, slender, yellowish, more or less straight and spreading, about ½ in. long; central spines 4, dusky red, stronger, the uppermost very short, the two laterals horizontal, the lowest longest (1 in.) and deflexed: flowers lemon-yellow, becoming 2–3 in. in diameter. Mexico.

35. **bícolor**, Gal. Globose-ovate, stout, 1½–4 in. in diam., sometimes becoming 8 in. high: ribs 8, oblique and obtuse, compressed, tuberculate-interrupted: lower radials and centrals variegated red and white; radials 9–17, spreading and recurved, slender and rather rigid, the lowest one ½–1 in. long, the laterals 1–2 in. long and about equaling the 2–4 flat flexuous ashy upper ones; centrals 4, flat and flexuous, 1½–3 in. long, the uppermost thin and not longer than the erect and rigid laterals, the lowest very stout, porrect and very long: flowers funnelform, bright purple, 2–3 in. long. Northern Mexico.

CC. *Ribs 13–27.*

36. **orthacánthus**, Link & Otto. (*E. flavovirens*, Scheidw.). Globose, yellowish green: ribs 12 or 13, vertical, acute: radial spines 14, unequal, straight and spreading; central spines 4, stronger, the lowest the largest; all the spines rigid, annulate, and grayish white. Mexico.

37. **intertéxtus**, Engelm. Ovate-globose, 1–4 in. high: ribs 13, acute, somewhat oblique, tuberculate-interrupted, the tubercles with a woolly groove: spines short and rigid, reddish from a whitish base and with dusky tips; radial 16–25, closely appressed and interwoven, the upper 5 to 9 setaceous and white, straight, one-fifth to ½ in. long, the laterals more rigid and a little longer, the lowest stout and short, a little recurved; centrals 4, the 3 upper ones turned upward and exceeding the radials and interwoven with them, the lower one very short, stout and porrect: flowers about 1 in. long and wide, purplish. Texas and northern Mexico.


746. Echinocactus myriostigma.

38. **Órcuttii**, Engelm. Cylindrical, 2–3½ ft. high, 1 ft. in diam., single or in clusters up to 18 or more, not rarely decumbent: ribs 18–22, often oblique: spines extremely variable, angled to flat, ¼–3 in. wide; radials 11–13, unequal, lowest and several laterals thinnest; centrals 4: flowers about 2 in. long, deep crimson in center, bordered by light greenish yellow. Lower California.

39. **Jóhnsoni**, Parry. Oval, 4–6 in. high: ribs 17–21, low, rounded, tuberculately interrupted, close set, often oblique, densely covered with stoutish reddish gray spines: radial spines 10–14, three-fifths to one and one-third in. long, the upper longest; centrals 4, stouter, recurved, about 1½ in. long: flowers 2 to two and three-fifths in. long and wide, from deep red to pink. Utah, Nevada, California.

40. **polycéphalus**, Engelm. & Bigel. Globose (6–10 in. in diam.) to ovate (10–16 in. high, 5–10 in. in diam.) and cylindrical (reaching 24–28 in. high and about 10 in. in

diam.), profusely branched at base: ribs 13-21 (occasionally 10): spines 8-15, very stout and compressed, more or less recurved and reddish; radials 4-11, comparatively slender (the uppermost the most slender), 1-2 in. long; the 4 centrals much stouter and longer (1⅕ to two and four-fifths in.), very unequal, the uppermost one usually broadest and curved upward, the lowest one usually the longest and decurved: flowers yellow. From Utah to northern Mexico.

41. **viridéscens,** Nutt. Globose or depressed, simple or branching at base, 4-12 in. high, 6-10 in. in diam.: ribs 13-21 (fewer when young), compressed and scarcely tuberculate: spines more or less curved and sometimes twisted, reddish below, shading into greenish or yellowish above; radials 9-20, two-fifths to four-fifths in. long, the lowest shortest, robust, and decurved; centrals 4, cruciate, much stouter, compressed and 4-angled, four-fifths to one and two-fifths in. long, the lowest broadest, longest and straightest: flowers yellowish green, about one and three-fifths in. long. Southern California.

42. **Leoóntei,** Engelm. Resembles Wislizeni, but often somewhat taller (sometimes becoming 8 ft. high and 2 ft. in diam.), usually more slender, and at last clavate from a slender base: ribs somewhat more interrupted and more obtuse: lower central spine more flattened and broader, curved (rather than hooked) or twisted, usually not at all hooked, sometimes as much as 6 in. long: flower rather smaller. From the Great Basin to Mexico and Lower California.

43. **Sileri,** Engelm. Globose: ribs 13, prominent, densely crowded, with short rhombic-angled tubercles: radial spines 11-13, white; centrals 3, black, with pale base, three-fifths in. long, the upper one slightly longer: flower scarcely 1 in. long, straw-colored. Utah.

44. **Grùsoni,** Hildmann. Globose, completely covered by a mass of almost transparent golden spines, which give the plant the appearance of a ball of gold; centrals 4, curved: flowers red and yellow. Mountains of Mexico. —From illustrations it is evident that the radial spines are somewhat numerous and widely spreading, and that the centrals are prominent and more or less deflexed.

45. **Saltilléndis,** Poselg. Very stout, globose: ribs 15-19, compressed, dark green: spines very prominent, 5-7 in a cluster, stout and porrect, sometimes becoming 5 in. long; centrals 4. Mexico.—Schumann makes this a variety of *E. ingens*.

746a. Mammillaria macromeris. For comparison with Echinocacti.

CCC. *Ribs 30 or more.*

46. **Scòpa,** Link & Otto. More or less cylindrical, 1 ft. or more high, 2-4 in. in diameter, at length branching above: ribs 30-36, nearly vertical, tuberculate; radial spines 30-40, setaceous, white; central spines 3 or 4, purple, erect; sometimes all the spines are white: flowers yellow. Brazil.—The species is exceedingly plastic in form, branching variously or passing into the cristate condition.

BBBB. *Central spines 5-10.*

47. **pilòsus,** Gal. Globose, 6-18 in. high: ribs 13-18, compressed, little if at all interrupted: radial spines represented by 3 slender ones at the lowest part of the pulvillus or wanting; centrals 6, very stout, at first purplish, becoming pale yellow, the 3 upper ones erect, the 3 lower recurved-spreading: flowers unknown. Northern Mexico.

48. **Símpsoni,** Engelm. Subglobose or depressed, turbinate at base, simple, often clustered, three and one-fifth to five in. in diam.: ribs 8-13, only indicated by the spiral arrangement of the prominent tubercles, which are ⅓ to three-fifths in. long, somewhat quadrangular at base and cylindric above: exterior spines 20-30, slender, rigid, straight, whitish, ⅛-½ in. long, with 2-5 additional short setaceous ones above; interior spines 8-10, stouter, yellowish and reddish brown or black above, erect-spreading, two-fifths to three-fifths in. long; no truly central spine: flowers three-fifths to four-fifths in. long and nearly as broad, yellowish-green to pale purple. Mountains of Colorado, Utah and Nevada.

AAA. *Spines entirely wanting.*

49. **turbinifórmis,** Pfeiff. Depressed-globose, grayish green, with 12-14 spirally ascending ribs, cut into regular rhomboidal tubercles; tubercles flat, with a depressed pulvillus, entirely naked excepting a few small setaceous spines upon the younger ones: flowers white, with a purplish base. Mexico.—The depressed and spineless body, with its surface regularly cut in spiral series of low, flat tubercles, gives the plant a very characteristic appearance.

50. **myriostigma,** Salm-Dyck (*Astrophýtum myriostigma*, Lem.). Fig. 746. Depressed-globose, 5 in. in diam.: ribs 5 or 6, very broad, covered with numerous somewhat pilose white spots, and with deep obtuse sinuses: spines none: flowers large, pale yellow. Mexico.

51. **Williamsii,** Lem. (*Anhalònium Williamsii*, Lem. *Lophóphora Williamsii*, Coult.). Hemispherical, from a very thick root, often densely proliferous, transversely lined below by the remains of withered tubercles: ribs usually 8 (in young specimens often 6), very broad, gradually merging above into the distinct nascent tubercles, which are crowned with somewhat delicate pencillate tufts, which become rather inconspicuous pulvilli on the ribs: flowers small, whitish to rose. Texas and Mexico.—The well-known "mescal button," used by the Indians in religious rites.

52. **Lewinii,** Hennings (*Anhalònium Lewinii*, Hennings. *Lophóphora Lewinii*, Coult.). Like *E. Williamsii*, but a much more robust form, with more numerous (usually 13) and hence narrower and more sinuous ribs, and much more prominent tufts. Along the Rio Grande. JOHN M. COULTER.

Other names of Echinocacti may be looked for under Echinocereus and Mammillaria. Echinocactus and Mammillaria are distinguished chiefly by the way in which the fls. are borne,—terminal on the tubercles in the former, and axillary to tubercles or ribs in the latter. In external appearance they are very similar. Some species may be referred to either genus or to both. *Mammillaria micromeris* (Fig. 302) is considered by some to be an Echinocactus. The strong resemblances between these two genera may be seen by comparing the Echinocacti in Figs. 745 and 746 with the Mammillaria in Fig. 746a. See, also, Figs. 1355-7 under Mammillaria.

ECHINOCÈREUS (*spiny Cereus*). *Cactàceæ.* Stems usually low and growing in thick clusters, which sometimes reach a considerable size: fls., as a rule, mostly short funnel-form: ovary and tube covered with bracts, from the axils of which are produced to a greater or less extent wool, bristles and spines: fr. globose to ellipsoidal, covered with spines until ripe. The genus is so closely allied to Cereus, and merges so gradually into it, that it seems impossible to draw a sharp line of distinction between them, and, indeed, by some authors they are combined under Cereus. For culture, see *Cactus, Cereus*, and *Echinocactus*.

INDEX

acifer, 19.
adustus, 24.
Berlandieri, 3.
Blankii, 4.
cæspitosus, 24.
chloranthus, 20.
chrysocentrus, 13.
coccineus, 17.
conglomeratus, 14.
conoideus, 17.
ctenoides, 23.
dasyacanthus, 22.
dubius, 7.
Engelmannii, 13.
enneacanthus, 6.
Fendleri, 12.
gonacanthus, 9.
longisetus, 10.
Merkeri, 8.
Mojavensis, 16.
paucispinus, 9.
pectinatus, 24.
phœniceus, 17.
polyacanthus, 18.
procumbens, 5.
rigidissimus, 24.
Rœtteri, 11.
rufispinus, 24.
Scheeri, 2.
stramineus, 15.
triglochidiatus, 9.
tuberosus, 1.
variegatus, 13.
viridiflorus, 21.

A. *Stems small, slender, cylindrical, much resembling Cereus.*

1. **tuberòsus**, Rümpl. (*Cereus tuberòsus*, Poselg.). Stems cylindrical, upright, or later reclining, clustered, from a number of more or less globular or ellipsoidal tuberous roots, the lower part woody and about the size of a lead pencil, the upper part more fleshy, about ½in. in diam., reaching a length of 1–2 ft.: ribs about 8, straight, low, rounded: areolæ very close together: radial spines 9–12, horizontally spreading, straight, white, thin subulate, very short; central solitary, subulate, from a tuberous base, about twice the length of the radials, white or brownish, with darker brown or black tips, directed upward, appressed: fls. from the end of the stem, about 2 in. long, tube covered with an abundance of white wool intermingled with bristles, rose-red to purplish: fr. ovoid, green, covered with the white wool and bristles. Tex. and northern Mex.

AA. *Stems prostrate, sometimes the branches upright when young, mostly less than 1 in. in diam.*

2. **Scheèri**, Lem. (*Cereus Scheèri*, Salm-Dyck). Branching freely from the base of the stem and forming dense clusters; branches upright or ascending, about 8 in. long by 1 in. in diam., slightly tapering toward the apex, dark green: ribs 8–9, straight or sometimes inclined to spiral, separated above by sharp grooves, which become flattened toward the base, low arched: areolæ little more than ¼in. apart, round, yellowish white: radial spines 7–9, spreading, needle-like, the under pair the longest, about ¼–⅜ in. long, white with yellowish bases; centrals 3, the lower the longest, about ⅜ in., red with brown bases; later all the spines become gray: fl. red, from the upper part of the stem, about 5 in. long: ovary and tube bracteate and furnished with abundance of wool and spines. Mex.

3. **Berlandièri**, Lem. (*Cereus Berlandièri*, Engelm.). Stems prostrate, richly branching, forming dense clusters, the branches upright or ascending, 2–3 in. long or longer by ½–¾ in. in diam., light or dark green, and in young growth often purplish: ribs 5–6, broken up into as many straight or spiral rows of tubercles, tubercles conical, pointed: areolæ ⅜–⅝ in. apart, round, white-woolly, soon naked: radial spines 6–8, stiff bristle-form, thin, horizontally spreading, white, about ⅜ in. long, the upper one sometimes light brown and somewhat stronger; central solitary, yellowish brown, sometimes reaching ¾ in. in length: fls. from the upper lateral areolæ, 2–3 in. long, red to light pink: fr. ovoid, green, bristly. Southern Tex. and northern Mex.

4. **Blánkii**, Palm. (*Cereus Blánkii*, Poselg.). Branching freely from the base and thus forming clusters: stems columnar, tapering above, about 6 in. long by 1 in. in diam., dark green: ribs 5–6 (rarely 7), straight, almost divided into tubercles: areolæ about ⅜ in. apart, round, white curly-woolly, later naked: radial spines mostly 8, horizontally spreading, the under pair the longest, reaching about ⅜ in. in length, all stiff, straight, thin, white or the upper ones carmine-red when young, later reddish brown; central solitary, porrect, later deflexed, 1–1¼ in. long, white or brownish, black when young: fls. from near the crown, 2½–3 in. long, purple-red to violet. Mex. R.H. 1865:90.

5. **procúmbens**, Lem. (*Cereus procúmbens*, Engelm.). Branching from the lower part of the stem, and so forming clusters: branches procumbent or ascending, angled, at the base tapering into cylindrical, 1½–5 in. long by ½–¾ in. in diam.: ribs mostly 5, rarely 4, straight or spiral, on the upper portion of the branch almost divided into tubercles: areolæ ¼–½ in. apart, round, sparingly white curly-woolly, soon naked: radial spines 4–6, subulate, stiff, straight, sharp, in young growth brownish, then white, at the base often yellowish and the tip brownish, horizontally spreading, the upper the longest, reaching ¼ in. in length; central solitary, or absent on the lower areolæ, somewhat stronger, ⅜–⅝ in. long, darker: fls. lateral, from just below the crown, 3–4 in. long, carmine-red to violet, with white or yellowish throat: fr. ellipsoidal, green, ⅝ in. long. Mex.

6. **enneacánthus**, Engelm. (*Cereus enneacánthus*, Engelm.). Freely branching at the base of the stem, and thus forming thick, irregular clusters: branches ascending, usually 3–5 in. long by 1½–2 in. in diam., green or sometimes reddish: ribs 8–10, straight, often divided by transverse grooves into more or less conspicuous tubercles: areolæ ⅜–⅝ in. apart, round, white curly-woolly, soon naked: radial spines 7–12 (mostly 8), horizontally spreading, needle-form, straight, stiff, translucent white, base bulbose, the under one longest, reaching about ½in., the upper one very short; central solitary, or seldom with two additional upper ones, straight, porrect or deflexed, round or angled, whitish to straw-yellow or darker, ⅜–1½ in. long; later all the spines are gray: fls. lateral, from near the crown or lower, 1¾–2½ in. long, red to purplish: fr. spherical, green to red, spiny, ¾–1 in. long. Tex. and northern Mex.

AAA. *Stems erect, more than 1 in. in diameter.*

B. *Ribs of stem 9 or less.*

7. **dùbius**, Rümpl. (*Cereus dùbius*, Engelm.). Tolerably thickly clustered; stems branching at the base, cylindrical or elongated ellipsoidal, 4½–7 in. high by 1½–2¼ in. in diam.: ribs 7–9, undulate: areolæ ⅜–⅝ in. apart, round, covered with short curly white wool, later naked: radials 5–8, subulate, horizontally spreading, stiff, round or faintly angled, the lower ones usually the longest, about 1 in. long, the upper ones about half as long, or sometimes absent, transparent white; centrals 1–4, stronger and longer, bulbose at the base, straight or curved, reaches 2½ in. in length, the lowest one longest, straight, porrect or deflexed, the upper ones spreading: fls. lateral, 2 in. long, rose-red to violet: fr. spherical, greenish to purple-red, covered with bundles of deciduous spines. Tex. and northern Mex.

8. **Mérkeri**, Hildm. Stems at first upright, columnar, later reclining, and by branching at the base forming clusters, in new growth bright green, later gray to gray-brown and corky: ribs 5–9, undulate to more or less tuberculate: areolæ ¾in. and more apart, round, white velvety, later naked: radial spines 6–9, the upper ones the longest, reaching 1¼ in. in length, somewhat confluent with the centrals, subulate, spreading, straight; centrals 1–2, stronger, reaching a length of 2 in.; all the spines are white, nearly transparent, with red-tinted bulbose base. Northern Mex.

9. **paucispinus**, Rümpl. (*Cereus paucispinus*, Engelm.). Clustered in irregular bunches: stems cylindrical to ovoid, 4–7 in. high by 1¾–3 in. in diam.: ribs 5–7, undulate: areolæ ⅜–⅝ in. apart, round, white woolly, later naked: radial spines 3–6, spreading, subulate, straight or curved, round, bulbose at the base, the lowest one longest, reaching ¾ in., light colored, the upper ones reaching to about ½ in., reddish or brownish; central solitary or none, reaching about 1½ in. in length, somewhat angled, brown-black, porrect or upright; later all the spines blackish: fls. 2 in. or more long, dark scarlet to yellowish. Tex. and Colo.

Var. **triglochidiàtus**, K. Sch. (*Echinocereus triglochidiàtus*, Engelm. *Cereus triglochidiàtus*, Engelm.). Radial spines usually 3, sometimes as many as 6, strong, angled, base bulbose, straight or curved, about 1 in. long, soon ash-gray. Tex. and New Mex.

Var. **gonacánthus**, K. Sch. (*Echinocereus gonacánthus*, Lem. *Cereus gonacánthus*, Engelm. and Bigel.). Radial spines 8, very large, angled and sometimes twisted, the upper strongest, reaching nearly 3 in. in length, light or dark yellow with brown tips; central always present, deeply grooved, often flattened, 3 in. or more long. Colo.

BB. *Ribs of stem about 9–13.*

10. **longisètus**, Lem. (*Cereus longisètus*, Engelm.). Stems clustered, cylindrical, covered with long, dirty white spines, about 8 in. high by 2 in. in diam., light green: ribs 11–14, straight, undulate: radial spines 18–20, straight, compressed, base thickened, subulate, flexuose, usually horizontally spreading, interlocking with adjacent clusters, the lower laterals the longest, reaching ⅜in. in length, the upper more bristle-like and the shortest, all white; centrals 5–7, longer, reaching 2½ in., stronger, the upper ones scarcely longer than the longest radials; all are bulbose at the base; the three lower ones the longest and deflexed, spreading and sometimes curved: fls. red. Mex.

11. **Rœ́tteri**, Rümpl. (*Cereus Rœ́tteri*, Engelm.). Loosely open clustered: stems upright, 4–6 in. high, 2–3 in. in diam., cylindrical or ovoid: ribs 10–13, straight: radial spines 8–15, subulate, thickened at the base, stiff, sharp, straight or slightly curved, the laterals longest, about ½ in., the upper ones shortest, reddish with darker tips; centrals 2–5, stouter, bulbose at base, ¼–⅜in. long, the lower ones the longest; later all the spines are gray: fls. lateral, from near the crown, 2½–3 in. long, purple-red to violet: fr. short ellipsoidal, spiny, green, ¾in. long. Tex. to Ariz. and northern Mex.

12. **Féndleri**, Rümpl. (*Cereus Féndleri*, Engelm.) Irregularly clustered: stem cylindrical or rarely ovoid or even globose, sparingly branching, 3–7 in. high by 1¾–2½ inch in diam.: ribs 9–12, straight or slightly spiral, undulate: radial spines 7–10, subulate, straight or curved, the lowest or the two lower laterals the longest, about 1 in., stronger, quadrangular, white; the two next higher brownish; the upper ones round, white and much shorter; all are bulbose at the base; central solitary (or in old plants 3–4), very strongly thickened at the base, round, black, sometimes with a lighter colored tip, curved upward, reaching a length of 1¾ in.: fls. lateral, from near the crown, 2–3½ in. long, dark carmine-red to purple and violet: fr. ellipsoidal, spiny, green to purple-red, about 1 in. long. Colo., Utah and south to northern Mex. B.M. 6533.

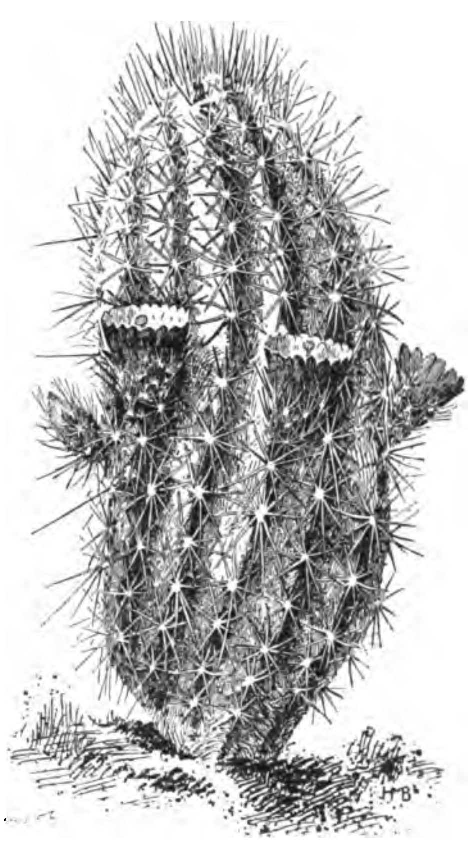
13. **Éngelmannii**, Lem. (*Cereus Engelmannii*, Parry). Stems clustered, cylindrical to ovoid, 4–10 in. high, 1¾–2½ in. in diam., light green: ribs 11–13, undulate: radial spines 11–13, somewhat angled, stiff, sharp, straight or somewhat curved, horizontally spreading, the lowest or lower laterals the longest, about ½ in., the upper ones the shortest, whitish with brown tips; centrals 4, stiff, straight, angled, stout, the lowest one deflexed, white to dark-colored, reaching a length of 2½in., the upper ones about ½ as long, spreading, brown: fls. lateral, from just below the crown, 1¾–2½ in. long, purple-red: fr. ovoid, green to purple-red, spiny, later naked, about 1 in. in diam.; pulp purple-red. Calif. to Utah and south into Mex.

Var. **chrysocéntrus**, Engelm. and Bigel. The three upper centrals golden yellow, the lowest white. Mojave desert, Calif.

Var. **variegàtus**, Engelm. and Bigel. The three upper centrals curved, horn-colored and mottled with black. Utah, Nev. and Calif.

14. **conglomeràtus**, Först. Stems clustered, columnar, somewhat tapering above, reaching a height of 1 ft. and 2 in. in diam., light green: ribs 12–13, strongly undulate, tubercled above: radial spines 9–10, glossy, spreading, the lower pair the longest, base yellow; centrals 1–4, the lowest straight, porrect, reaching a length of 1½ in. and more, somewhat stronger than the rest. Northern Mex.

15. **stramíneus**, Rümpl. (*Cereus stramíneus*, Engelmann). Clustered in thick, irregular bunches: stems ovoid to cylindrical, 4–8 in. long, 1½–2½ in. in diam.: ribs 11–13: radial spines 7–10 (usually 8), horizontally radiate, straight or slightly curved, subulate, sharp, round or the long lower ones angled, transparent white, tolerably equal in length, about ½–¾ in. or the lower ones sometimes longer and reaching a length of 1½ in.; centrals 3–4, much longer, stronger, twisted, angled, straw yellow to brownish, when young reddish transparent, the upper ones shortest and spreading upward, the lower ones porrect or depressed: fls. lateral, 2½–3½ in. long, bright purple-red or deep dark red to scarlet: fr. ellipsoidal, about 1½ in. long, covered with numerous spines, purple-red. Tex. to Ariz. and northern Mex.



747. Echinocereus chloranthus.

16. **Mojavénsis**, Rümpl. (*Cereus Mojavénsis*, Engelm. and Bigel.). Stems clustered, ovoid, reaching 3 in. in height by 2 in. in diam.: ribs 8–12, conspicuously undulate: radial spines 5–8, the lowest pair the longest, reaching about 2¼ in. in length; all are white with brown tips, subulate, straight or curved, strongly bulbose at the base; central solitary, or sometimes absent, stronger and somewhat longer and darker colored; later all the spines become gray: fls. 2–3 in. long, deep carmine: fr. ellipsoidal, about 1 in. long. Mojave desert of Ariz., Nev. and Calif.

17. **phœníceus**, Lem. (*Echinocereus coccíneus*, Engelm. *Cereus phœníceus*, Engelm.). Stems irregularly clustered, ellipsoidal to short cylindrical, 2–4 in. high by 1½–2¼ in. in diam.: ribs 8–11, straight: spines bristle-form, straight, round; radials 8-12, white, ¼–½ in. long, upper ones shortest; centrals 1–4, stouter, white to yellow or brown, with bulbose base: fls. from upper lateral areolæ scarlet-red, with the corolla throat yellow. Colo. to Ariz.

Var. **conoideus**, Engelm. (*Echinocereus conoideus*, Rümpl. *Cereus conoideus*, Engelm.). Central spine long and robust: fls. large, red. Southern Calif. and northwest Mex.

18. **polyacánthus**, Engelm. (*Cereus polyacánthus*, Engelm.). Stems clustered, forming thick masses, cylindrical to ellipsoidal: ribs 9–13: radial spines 8–12, robust, subulate, stiff and sharp, under one the longest, nearly 1 in., upper ones scarcely ½ in., white to reddish gray with dark tips; centrals 3–4, bulbose base, stronger, about the length of the radials or the lowest sometimes reaching 2 in., horn-colored; later all the spines become gray: fls. lateral, about 1¾–2¼ in. long, dark scarlet to blood-red: fr. spherical, about 1 in. long, greenish red, spiny. Tex. to Calif. and northern Mex.

19. **ácifer**, Lem. (*Cereus ácifer*, Otto). Stems thickly clustered, 6–8 in. high by 1½–2 in. in diam., becoming gray and corky with age: ribs 9–11, usually 10: radial spines usually 9, spreading, under pair longest, about ½ in., in young growth white, later horn-colored to gray, the upper ones brownish; central solitary, straight, porrect, at first ruby red, later brown, 1 in. long: fls. lateral, 2 in. and more long, clear scarlet-red, with a yellow throat and sometimes a carmine border. Northern Mex.

BBB. *Ribs of stem 13 or more.*

20. **chloránthus**, Rümpl. (*Cereus chloránthus*, Engelm.). Fig. 747. Stems in small clusters, cylindrical, slightly tapering above, 4–9 in. high by 2–2½ in. in diam.: ribs 13–18, straight or rarely spiral: radial spines 12–20, horizontally spreading and appressed, sharp, the shortest one about ⅜in. long and white, the lower laterals a little longer and have purple tips; centrals 3–5, or in young plants absent, bulbose at the base, the upper ones shortest, about the length of the radials, and darker colored, with purplish tips, the lower ones stouter, about 1 in. long, deflexed, white; frequently all the spines are white: fls. lateral, little more than 1 in. long: ovary and tube white bristly; petals green: fr. ellipsoidal, about ½in. long, spiny. Texas and New Mexico.

21. **viridiflòrus**, Engelm. (*Cereus viridiflòrus*, Engelm.). Stems solitary or only in age forming small, loose clusters, cylindrical or elongated ellipsoidal, 3–7 in. high by 1–2 in. in diam.: ribs 13: radial spines 12–18, horizontally radiate, pectinate, straight or somewhat curved, subulate, the lower laterals the longest, about ½ in., translucent ruby red, the others white; centrals usually absent, rarely 1, strong, about ¾ in. long, curved upward, red with brown point: fls. lateral, from just below the crown, broad funnel-form, little more than 1 in. long: ovary and tube spiny: corolla green, with a broad darker olive green to pink stripe down the middle of each petal: fr. ellipsoidal, about ½ in. long, greenish. Wyo. and Kans. to Tex. and New Mex.

22. **dasyacánthus**, Engelm. (*Cereus dasyacánthus*, Engelm.). Stems solitary or sometimes forming open clusters, ellipsoidal to short cylindrical: ribs 15–21, straight or sometimes slightly spiral, obtuse: radial spines 20–30, straight or sometimes slightly curved, subulate, stiff, sharp, pectinate, white with red or brown tips, later gray, the laterals longest, ½–1 in., the upper ones shortest, about ⅜ in., those of one cluster interlocking with those of the adjacent clusters; centrals 3–8, the lower one longest, white with colored tips, mostly with bulbose bases: fls. from near the crown of the stem, large, 2½–3 in. long: ovary and short tube covered with white, reddish tipped stiff bristles; corolla yellow: fr. 1–1½ in. long, ellipsoidal, spiny, green to reddish. Tex.

23. **ctenoides**, Lem. (*Cereus ctenoìdes*, Engelm.). Stems solitary or rarely branching, cylindrical to elongated ovoid, reaching a height of 6 in. and a diam. of 2½ in.: ribs 15–16, usually straight: radial spines 13–22, horizontally radiate, pectinate, subulate, bases bulbose and laterally compressed, stiff, straight or often slightly curved, the laterals longest and about ⅜ in., the upper ones very short, white or sometimes with brownish tips; centrals 2–3 or rarely 4, superposed, coarser, bulbose at the base, short and conical to ¼ in. long, reddish; later all the spines are gray: fls. lateral, from near the crown, 2½–3 in. long: ovary and short tube white bristly: corolla yellow, with greenish throat. Tex. and northern Mex.

24. **pectinàtus**, Engelm. (*Cereus pectinàtus*, Engelm.). Clustered stems cylindrical or ovoid, reaching a height of 10 in. by 3 in. diam.: ribs 13–23, straight: radial spines 16–30, pectinate, horizontally spreading and appressed, straight or curved, the laterals longest, round, hardly ⅜ in. long; central usually absent, or as many as 5, which are short, conical and superposed, white, with tips and bases variously colored with pink, yellow or brown; later all become gray: fls. lateral, from near the crown, 2½–4 in. long: ovary tuberculate and spiny, light to dark rose-red or rarely white: fr. globose, spiny, green to reddish green. Mex.

Var. **adústus**, K. Sch. (*Cereus adústus*, Engelm.). Like the type, but with black-brown to chestnut-brown spines. Mex.

Var. **rigidissimus**, Engelm. (*Cereus cándicans*, Hort. *C. rigidissimus*, Hort.). RAINBOW CACTUS. Fig. 748. Stems comparatively shorter and thicker: radial spines 16–20, coarser and stiffer, straight or very little curved; base thickened, white, yellow or red to brown, these colors commonly arranged in alternating bands around the plant, the spines of adjacent clusters interlocking; centrals absent. Tex. to Ariz. and northern Mex.

748. Echinocereus pectinata, var. rigidissimus.

Var. **cæspitòsus**, K. Sch. (*Echinocereus cæspitòsus*, Engelm. *Cereus cæspitòsus*, Engelm.). Radials 20–30, curved, clear white or with rose-red tips; centrals absent, or 1–2 very short ones. Indian Terr., Tex. and Mex.

Var. **rufispinus**, K. Sch. Of more robust growth: radial spines curved, red. Mex.

Horticultural names unidentified: *E. polycéphalus.—E. sanguíneus.—E. Uehri.—E. Uspénskii.—E. paucupina*, no doubt a mutilation of paucispinus.—*E. Schlini*—E. Scheeri?

C. H. THOMPSON.

ECHINOCÝSTIS (Greek, *hedge-hog* and *bladder;* from the prickly fruit). *Cucurbitàceæ.* WILD CUCUMBER. WILD BALSAM-APPLE. This genus contains a hardy native annual vine which is a great favorite for home arbors, although not especially beautiful in foliage, flower or fruit. Its bladdery fruits about 2 in. long, covered with weak prickles, are a source of unfailing delight to children, who love to make them burst. It is one of the quickest growing of all vines, and is therefore useful in hiding unsightly objects, while the slower-growing shrubbery is getting a start. The latest reviewer of the gourd family (Cogniaux, in DC. Mon. Phan. vol. 3, 1881) makes three sections of this genus, and this plant the sole representative of the second section, or true Echinocystis, because its juicy fruit bursts irregularly at the top, and contains 2 cells, each with 2 flattish seeds.

lobàta, Torr. & Gray. Lvs. wider than long, deeply 5-lobed, slightly emarginate at the base: tendrils 3–4-branched: staminate fls. small, in many-fld. panicles longer than the lvs.; calyx glabrous: fr. egg-shaped, sparsely covered with prickles. Saskatchewan to Winnepeg, south to Va. and Ky., west to Colo. A.G. 14: 161. R.H. 1895, p. 9. G.C. III., 22:271. Sometimes becomes a weed.

W. M.

ECHÌNOPS (Greek, *like a hedgehog;* alluding to the spiny involucral scales). *Compósitæ.* GLOBE THISTLE. A large genus of thistle-like plants, with blue or whitish flowers in globose masses. The structure of one of these globes is very curious. Each flower in the globe has a little involucre of its own, and the whole globe has one all-embracing involucre. Another way of saying the same thing is "heads 1-fld., crowded into head-like glomes." More or less white-woolly herbs: lvs. alternate, pinnate-dentate or twice or thrice pinnatisect, the lobes and teeth prickly.

Globe Thistles are coarse-growing plants of the easiest culture, and are suitable for naturalizing in wild gardens and shrubberies. An English gardener with an eye for the picturesque (W. Goldring) recommends massing them against a background of *Bocconia cordata*, or with such boldly contrasting yellow- or white-flowered plants as *Helianthus rigidum* or *Helianthus multiflorus*. The best species is *E. Ruthenicus*. A few scattered individuals of each species are not nearly so effective as a condensed mass or group of one kind. *E. Ruthenicus* flowers in midsummer and for several weeks thereafter. The silvery white stems and handsomely cut prickly foliage of Globe Thistles are interesting features. They make excellent companions for the blue-stemmed Eryngiums. All these plants are attractive to bees, especially *E. exaltatus*, which has considerable fame as a bee-plant. Globe Thistles are sometimes used abroad for perpetual bouquets.

A. *Leaves not pubescent nor setulose above.*

Ritro, Linn. Tall, thistle-like plant, with pinnate-lobed lvs., which (like the stems) are tomentose beneath, the lobes lanceolate or linear and cut, but not spiny: involucre scales setiform, the inner ones much shorter: fls. blue, very variable. Var. **tenuifòlius,** DC. (*E. Ruthénicus*, Hort.) has the lower leaves more narrowly cut, more or less spine-tipped. Gn. 45:951.—Perennials of S. Eu., growing 2–3 ft. high. They bloom all summer. Lvs. sometimes loosely webby above.

AA. *Leaves pubescent or setulose above.*

Bannáticus, Rochel. Lvs. hairy-pubescent above, tomentose beneath (as also the stems), the lower ones deeply pinnately parted, the upper pinnatifid, spiny: fls. blue. Hungary. R.H. 1858, p. 519.

exaltàtus, Schrad. Tall biennial, the stem nearly simple and glandulose-pilose, the lvs. pinnatifid, scarcely spiny: fls. blue. Russia. B.M. 2457 as *E. strictus*, Fisch. Distinguished by its simple, erect stem. The garden *E. commutàtus* may be the same as this.

sphærocéphalus, Linn. Tall (5–7 ft.) perennial: lvs. pinnatifid, viscose-pubescent above, tomentose below, the teeth of the broad lobes yellow-spined: fls. white or bluish. S. Eu. B.R. 5:356.

L. H. B.

ECHINÓPSIS (Greek, *hedgehog-like*). *Cactàceæ.* SEA-URCHIN CACTUS. Stems spherical to ellipsoidal or rarely columnar: ribs prominent and usually sharp-angled: fls. usually long trumpet-shaped, ovary and tube covered with linear-lanceolate, cuspidate bracts which become longer toward the outer end of the tube, where they pass gradually into the outer petals, in their axils bearing long, silky, wavy hairs and usually a few rather rigid bristles. This is a well marked genus, though by some authors combined with Cereus, confined entirely to South America. Culture as for Cereus.

A. *Ribs of stem divided into more or less evident tubercles.*

Péntlandii, Salm-Dyck. Stem simple, later branching, spherical or ellipsoidal, reaching 6 in. in diam.: ribs 12–15, divided between the areolæ into oblique compressed tubercles: radial spines 9–12, spreading, straight or slightly curved, yellowish brown, the upper the longest and strongest, reaching ½–1¼ in.; central solitary, or seldom in pairs, porrect, curved, 1–1½ in., rarely 3 in. long: fls. lateral, 2–2½ in. long, yellow, orange, pink to scarlet-red: fr. spherical, green, ¾ in. in diam. Peru. B.M. 4124.

AA. *Ribs of stem not divided.*

B. *Flowers red or pink.*

múltiplex, Zucc. Stems at first rather clavate, later globose to ellipsoidal, abundantly branching, 6–12 in. in diam. and the same in height, or rarely taller, light green to yellowish: ribs 12–14, straight, scarcely undulate: radial spines about 10, subulate, straight, yellow to yellowish brown, with darker tips, reaching ¾ in. in length, very unequal, horizontally spreading; centrals mostly 4, of these the lowest is the longest, reaching 1½ in., somewhat porrect at first, later curved and deflexed, darker colored than the others: fls. rare, lateral, 11–15 in., rose-red. S. Braz. B.M. 3789.

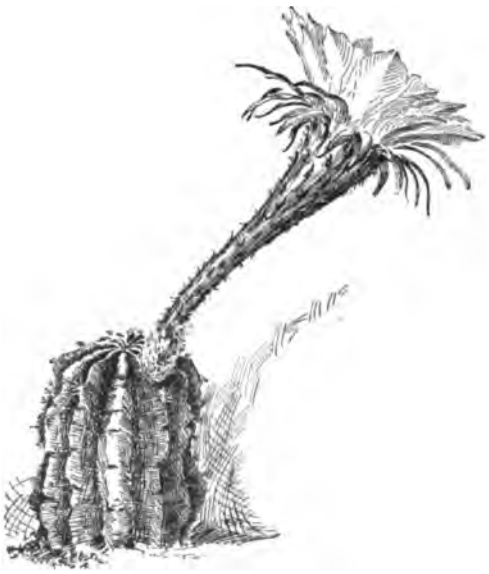
Var. **cristàta,** Hort. Stems flat and spreading in growth, like an open fan or the flower stalk of the common garden cockscomb, spines reduced to fine, stiff bristles. This is merely a montrosity of the species.

oxýgona, Zucc. Stems at first simple, nearly spherical or rarely clavate, becoming short columnar, reaching 1½ ft. in height and 1 ft. in diam., gray-green, darker above: ribs 13–15, straight or wavy at the base: radial spines 5–15, horizontally spreading, very unequal, reaching ⅝ in., subulate, obliquely upright; centrals 2–5, somewhat longer, straight, porrect or deflexed, dark horn-colored, with black tips: fls. commonly many together, lateral, reaching 13 in. in length, pink to carmine-red, the inner petals lighter than the outer ones. S. Braz.

triúmphans, Jacobi. This is a hybrid between *E. Eyriesii* and *oxygona*, with pink double flowers.

BB. *Flowers white.*

Eyrièsii, Zucc. Stem simple, commonly branching later, at first somewhat depressed, later short to rather tall columnar, reaching a height of 2 ft. and a diam. of 4–6 in., dark green: ribs 11–18, straight, undulate, with sharp-angled margins: radial spines about 10, scarcely more than ⅛ in. long, rigid, straight, slender conical, pointed, dark brown to black; centrals 4–8, but very little different from the radials: fls. lateral, 10–15 in. long,



749. Echinopsis gemmata.

white: fr. small, ellipsoidal, about 1 in. long. S. Braz., Uruguay and Argentine Republic. B.M. 3411. B.R. 20:1707.

gemmàta, K. Sch. (*E. turbinàta*, Zucc.). Fig. 749. Stem simple or sometimes branching, at first low spherical or short columnar, later more top-shaped, reaching 1 ft. in height by 4–6 in. in diam., dark green: ribs 13–14, rarely more, straight or sometimes slightly spiral with sharp or obtuse margins, which are but little or not at all undulate; central spines appear first, about 3–6 in number, very short, stiff, black; later the radials appear, about 10–14, longer, horizontally spreading, at first yellowish brown, later horn-colored: fls. lateral or from the upper areolæ, 9–10 in. long, clear white, with a pale greenish midline in the petals. S. Braz.

tubiflòra, Zucc. (*E. Duvàlii*, Hort. *E. Zuccarínii*, Pfeiff.). Stems spherical to ellipsoidal, at first simple but later more or less branching, reaching 10 in. in height by 8 in. in diam., dark green: ribs 11–12, straight, with margins inconspicuously undulate: radial spines numerous, sometimes as many as 20, unequal, horizontally or obliquely spreading, yellowish white with brown tips, sometimes darker; centrals 3–4, the lowest the longest, reaching ⅝in., later deflexed: fls. lateral, about 14 in. long, white with pale green midline in the petals. S. Braz. and Uruguay. B.M. 3627.

Echinopsis Mulleri is a horticultural name only.

C. H. Thompson.

ECHINÓSTACHYS (*spiny head*, from the Greek). A bromeliaceous genus, now referred by Mez to Æchmea, which see. Three species have been offered in the Amer. trade: **E. Hystrix,** Wittm., for which see p. 28. **E. Pineliàna,** Wittm., which is *Æ. Pineliàna*, Baker: 2–3 ft.: peduncle and bracts brilliant red: lvs. banded, spine-edged: spike dense, 2 in. long, spiny: petals yellow, the tips fringed and incurved. Brazil. B.M. 5321. **E. Van Houtteàna,** Van Houtte, is *Æ. Van Houtteàna*, Mez (*Quesnelia Vàn Houtteana*, Morr.). Lvs. many, strong spined, sometimes white-banded beneath: fls. white, blue-tipped, in a crowded spike: 1–2 ft. Brazil.

L. H. B.

ECHÌTES (Greek, *viper;* possibly from its poisonous milky juice or from its twining habit). *Apocynàceæ.* A large genus of tropical American twiners related to Dipladenia. and of similar culture. Differs technically from Dipladenia in the 5-lobed disk and the glandular or 5-scaled calyx.

Ándrewsii, Chapman (*E. suberécta*, And.). Lvs. 1⅛–2 in. long, close together, oval or oblong, mucronate, acute or rounded at the base, margins revolute: peduncles axillary, 3–5-fld., shorter than the lvs.: fls. yellow; corolla tube 1 in. long, ⅛in. wide, much dilated above the insertion of the stamens, bell-shaped, scarcely longer than the lobes; anthers tapering into a long, bristle-like awn: glands of the nectary 5, rounded, as long as the ovaries. Sandy shores, S. Fla. W. Indies.

paludòsa, Vahl. Lvs. oblong, oval-oblong, or lanceolate-oblong, rounded toward the mucronate top: calyx segments glandular, devoid of an interior scale, oblong, mucronate-blunt, spreading; corolla tube funnel-shaped above a cylindrical base; anthers oblong-lanceolate, acuminate, rounded-cordate at the base, hirsute on the back above.

umbellàta, Jacq. Lvs. ovate or ovate-roundish, mucronate: fls. greenish white; calyx segments glandular, devoid of an interior scale; corolla tube cylindrical, enlarged below the middle, tapering again above; anthers rigid, tapering from a hastate base, glabrous. W. Indies.

W. M.

ÉCHIUM (Greek, meaning unknown). *Borraginàceæ.* Viper's Bugloss. Coarse herbs and shrubs, with spikes of blue, violet, red or white flowers. Their nearest ally of garden value is Cerinthe, but they are very distinct in general appearance. *E. fastuosum*, for instance, has dark blue, 5-lobed flowers about half an inch across, in spikes 6 inches long and 2 inches wide, perhaps as many as 200 fls. in a spike. Great masses of stamens are thrust out and add to the interest, and the young flower-buds look like pink 5-pointed stars. Three kinds are cult. outdoors in California. There being no published American experience with their cultivation under glass, the following points are gleaned from The Garden 42, p. 884 (1892). In rich soil they grow coarse and scarcely flower, and the flowers are never as richly colored as when the plants are more or less starved. Biennials seed freely, and the seed is sown as soon as gathered. *E. callithyrsum* is a greenhouse shrub or small tree which produces hundreds of spikes during summer. After flowering "the old stems or branches are cut back, when the plant breaks away again, and in this way may be had in bloom almost at will." Cuttings strike freely, flower soon, and make good pot-plants. Seedlings require a greater age and size before blooming. *E. fastuosum* is the handsomest of the shrubby kinds, grows 2–4 ft. high, has long, pale green lvs., covered with soft white hairs, and fls of a peculiarly brilliant deep blue. In California, Franceschi says, Echiums are eminently suited for dry places, and need good drainage. *E. vulgare* is a common weed in the East.

A. *Fls. dark blue.*

cándicans, Linn. f (*E. fastuòsum*, Jacq. f., not Ait.). Forms a bush 3 ft. high, but flowers at 3 ft., and its foliage is green when fresh, hoary white when dry. Branches thick, leafy toward the tips: lvs. lanceolate, the upper ones smaller, crowded and narrower: panicles much looser than the spikes of *E. fastuosum:* fls. sessile, pale blue, the buds reddish purple. Madeira. B.M. 6868. B.R. 1:44.—The fls. are sometimes said to be streaked with white or all white.

AA. *Fls. pale blue.*

fastuòsum, Ait., not Jacq. This has darker blue fls. in a dense spike and perhaps less hoary foliage than *E. candicans*. This was Hooker's conception in 1886 of the relation of the two species, but De Candolle formerly held the opposite opinion. Canaries. R.H. 1876:10. Gn. 10:50.

AAA. *Fls. white.*

símplex, DC. Woody but biennial and not branched: lvs. ample, oval-lanceolate: panicle very long, cylindrical, spike-like, the spikelets 2-fld., pedicelled: stigmas simple.

W. M.

EDELWEISS. See *Leontopodium.*

EDGEWÓRTHIA (after M. P. Edgeworth, English botanist in E. Indies, and his sister Maria). Deciduous shrub, with stout branches: lvs. alternate, entire, short-petioled, crowded at the end of the branches: fls. in dense, peduncled heads, axillary, on branches of the previous year, with or before the lvs., apetalous; perianth tubular. 4-lobed, densely pubescent outside; stamens 8, in 2 rows; stigma elongated: fr. a dry drupe. One species from Himal. to Japan, the bark of which is used for paper-making. Ornamental shrub, with handsome foliage and yellow, fragrant fls. Hardy only South, thriving in any good, well-drained garden soil; if grown in pots a sandy compost of peat and loam, with sufficient drainage given, will suit them. Prop. by greenwood cuttings in spring under glass; also by seeds, obtained from dealers in Japanese plants.

Gárdneri, Meissn. (*E. papyrífera*, Zucc. *E. chrysántha*, Lindl.). Lvs. elliptic or oblong-lanceolate, appressed pubescent when young, glabrous above at length, 3–8 in. long: fls. about 1 in. long, densely clothed with yellowish silky hairs outside, in dense heads about 2 in. in diam. B.M. 7180. B.R. 33:48. F.S. 3:289.—Cannot withstand the long, dry summers South.

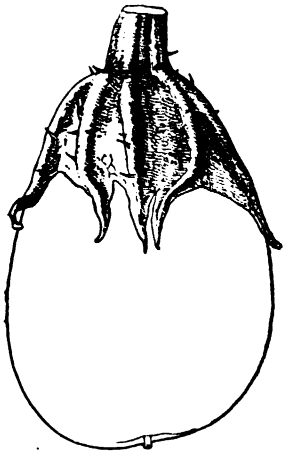
Alfred Rehder.

EDRAIÁNTHUS. See *Wahlenbergia.*

EDWÁRDSIA. The leguminous genus of this name is now included in *Sophora.*

EEL-GRASS. *Vallisneria spiralis.*

EGGPLANT (*Solànum Melongèna*, Linn.). *Solanàceæ.* Guinea Squash. Aubergine of the French. This plant is a native of the tropics, probably from the East Indies, but its native land is not known. It is cultivated to a greater or less extent throughout the entire tropical regions. The first reports of its use as a vegetable come from India, hence the above assumption. In the United States it is cultivated as a vegetable as far north as New York, but it usually grows to greater perfection in the southern states. The demands for it during the early months of the year have not been fully supplied. Its cultivation demands as much a specialist as either celery or tobacco, while the specialization must be in a different direction from that of either one of these. Nearly all of the fruit that grows to proper size is edible, and there is no special demand for particular flavors. Eggplants are forced under glass to a limited extent for home use. They require the temperature of a tomato house, and great care must be taken to keep off red spider and mites. In order to insure large fruits, practice artificial pollination. Non-pollinated fruits will grow for a time, but always remain small (Fig. 750). (Cf. Bailey, Forcing-Book.)



750. Non-pollinated fruit.

Soil. — Eggplant will grow on almost any soil in the South, but it develops to greater perfection on a rich, deep, loamy soil free from debris. In the clay districts this is not easily obtained, but there are often small fields that are sufficiently dry and yet contain enough sand to make Eggplant growing profitable. No matter whether clay land, loam or sandy land be employed for raising this crop, it will be necessary to plow deeply and thoroughly. The land should be drier than that required by cabbage or beets. In fact, it will stand a greater drought than the ordinary vegetables. On the other hand, we should not attempt to grow a crop on land that is composed of large particles, such lands as are ordinarily called thirsty in the vegetable-growing sections of Florida.

Fertilizer.—There is considerable difference in various sections of the country as to whether manure may be applied or not. In the south Atlantic and Gulf states it is not advisable to use stable manure. If this form of fertilizer is at hand, the gardener should make it up in the form of compost, when it will be found to be a very useful material. There have been no experiments performed to indicate which forms of chemical fertilizers are the best. In the absence of such work, we can only give general directions in regard to what may be used. The following formula will be found fairly well balanced for Eggplant in the South. If the soil contains a great deal of humus, less nitrogen may be used. If the soil is poor in this element, nitrogen, a greater amount of nitrogen may be used. On moderately fertile land 500 to 1,000 pounds will be sufficient, while on poor lands as much as 2,500 to 3,000 pounds per acre may be employed.

FERTILIZER FORMULA.

Nitrogen	4%
Potash	9%
Available phosphoric acid	5%

The following table of fertilizers will suggest useful amounts of the different elements when we wish to employ 500 pounds of the above formula to the acre (particularly for the South):

Nitrogen	350 lbs. cotton seed meal; or, 200 lbs. dried blood; or, 150 lbs. nitrate of soda; or, 100 lbs. sulphate of ammonia.
Potash	500 lbs. kainit; or, 90 lbs. muriate of potash; or, 200 lbs. sulphate of potash and sulphate of magnesia.
Phosphoric acid	250 lbs. acid phosphate; or, 200 lbs. dissolved bone.

Propagating the Seedlings.—The time required to bring plants into bearing from seeds varies with the conditions of the soil and temperature. During cool weather the plants grow very slowly, but during hot weather they grow rapidly and mature fruit in much less time. Those who wish to have early fruit and are able to use hotbeds or propagating houses should sow the seed 120 to 150 days before the fruit is wanted. Prepare the hotbeds as for other seedlings, and sow in rows a few inches apart. When these are beginning to show their leaves, or when the seedlings are beginning to look spindly, they should be pricked out and transferred to another bed. In this each plant should be given about a 2-inch square; then they may be forced until the plants crowd one another in the bed, when they should be transferred again. When the plants have attained the size of 6 inches, and the atmosphere will permit, they may be set out in the field.

A somewhat more laborious, but at the same time more successful plan, is to plant the seedlings in 2-inch flower pots, and then shift to larger ones as often as the plants become pot-bound or crowd one another in the bed. Fig. 751 represents a plant, three-tenths natural size, just taken from a flower pot and ready to be shifted to a larger one. By shifting until 6-inch pots are reached, the Eggplant may be forced along without injury to blooming size or even to a size when fruit is beginning to set, and then set out in the field without injury to the plants or crop.

Eggplant growers should bear in mind constantly that from the time of sprouting the seeds to the harvesting of the crop, the plants cannot stand a severe shock in their growth without detriment to the crop. When the plant is once started it should then be forced right along, and never allowed to become stunted during its growth. The amount of damage done by neglecting plants before they are set to the field varies with the severity of the shock and the length of time during which the plant undergoes the disadvantageous conditions. If it becomes necessary to harden the plants off before setting them to the field, this should be done gradually.

Culture in the Field.—After the field has been thoroughly prepared in the way of plowing and fertilizing, which should have been done at least two weeks before the plants were set out, the rows should be laid off from 3 to 4 feet apart. The plants may be set from 2 to 4 feet apart in the row, varying with the varieties to be used and the soil. Tillage should be continued, and varied according to the conditions of the weather. During a wet season it is well to cultivate the land as deeply as possible, while during dry weather cultivation should be shallow, simply sufficient to keep the weeds from growing, to keep the soil well aired, and to keep a mulching of dry soil on the land. Under ordinary circumstances it does not pay to prune or pinch out the buds, but where the season is short this may be resorted to with some advantage. If it is desirable to

751. Pot-grown plant ready for setting in the field.

have the fruit attain a certain size before frost, one may begin to pinch out the blossoms and new growth about three weeks before its usual occurrence. This same process will be of advantage where the fruit is to be brought into market at a certain time.

752. Field-grown plant of New York Improved Eggplant.

Marketing.—As a rule, it is better to cut the fruit from the plant than to break it, especially if the work is done by careless laborers. After cutting, it may be placed in large market baskets and hauled to the packing house. For distant market, the fruits should be wrapped separately in heavy brown paper. The proper crate for this vegetable is the barrel crate. As this is considered one of the staple vegetables, we do not gain much by using fancy wrappers or packing it in fine crates, hence we may use such material as may be left over from shipping fancy vegetables. It also stands shipment to distant markets, so that, if there is no danger of reduction in price, it is quite as well to ship by freight as by express.

Varieties.—There are only a few varieties offered in the market. The New York Improved Spineless matures a little earlier than the Black Pekin. The New York Purple (Fig. 752), Black Pekin, and the New York Spineless are excellent for shipping purposes. The above varieties are the black-fruited, and the most popular in the United States, while the white-fruited sorts are said to be the most popular in Europe. For home use, the white-fruited varieties are preferable, but as these make poor sellers in the United States, we must raise the purple sorts for market. For home gardens, the early and small Early Dwarf Purple (Fig. 754), is useful. It is particularly recommended for northern climates. There are three main types of Eggplants, as follows (Bailey, Bull. 26, Cornell Exp. Sta.): The commoner garden varieties, *Solànum Melongèna*, var. *esculéntum*, Bailey (Figs. 752, 753); the long-fruited or "serpent" varieties, *S. Melongèna*, var. *serpentìnum*, Bailey; the Early Dwarf Purple type, var. *depréssum*, Bailey (Fig. 754). See *Solanum*. The so-called Chinese Eggplant is a different species, for which consult Solanum.

Seed-growing.—This is by no means a difficult operation, and may be done profitably in certain sections of the South. For this purpose all defective or dwarfed plants in the field should be cut out. By a little attention one will be able to know when the seeds have matured sufficiently for gathering. At this time the eggs usually turn a lighter color or even somewhat yellow. The fruit should be gathered and carried to the packing house, where it may be left in a pile for 2 or 3 days, as there is very little danger from rotting. When a sufficient number have been collected the laborers may be set to paring off the extra amount of meat on the outside of the seed. The remaining core may then be cut longitudinally into quarters or eighths, using a dull knife to avoid cutting the seed. After a quantity of these have been pared, they may be placed in a barrel and covered with water. The barrel should not be made more than two-thirds full. In a day or two fermentation will set in and the meaty portion will macerate from the seed. The seed may then be separated from the meat by means of sieves, using first wide-meshed ones to remove the meat and then finer-meshed ones to screen out the seed from the finer pulp. The seed should not be allowed to stand more than 2 or 3 days in the macerating barrel, as the heat evolved by fermentation and the heat of the summer is liable to cause them to germinate. After separating the seed from the pulp, it should be dried in the shade and wrapped in secure packages. By covering with tin foil or oil paper, the atmospheric moisture will be kept out and molding prevented.

Diseases.—The most destructive of diseases in the lower South is a blight fungus which attacks the plant just beneath the surface of the ground, causing the softer tissues at this point to rot off and the plant to die. The fungus is not able to penetrate the harder portion of the stem, consequently the plant lingers along for weeks after being attacked. A number of attempts have been made to cause this blight fungus to produce fruiting organs so that it could be classified, but up to the present this has proved futile. In such cases as this we have no remedy. After the plant is attacked, it is usually doomed. Much, however, can be done in the way of preventing the spread of this fungus. If all plants are destroyed as soon as found to be affected, the fungus cannot perfect its sclerotia, or resting state, and thus its propagating is prevented. The normal home of this fungus is in decaying vegetable matter. If, therefore, we keep our field free from this sort of material we will do much to prevent this fungus from being present. Some soluble form of fungicide, as Eau Celeste

753. Long White Eggplant.

or potassium sulphide, may be sprayed about the roots of the plants to good advantage. Practice rotation of crops.

A second form of blight is caused by *Bacillus solanacearum*, Smith. This disease has its origin of infection in the leaves, and is introduced by means of insects which have fed upon diseased plants and carried the infection to the well ones. The disease works rapidly down the tissues, and causes the death of the leaf and finally of the whole plant. The only remedy for this is to destroy all plants that are affected with the disease as soon as detected, and kill off all insects. When this disease is known to be present in a section, it is best to set the plants as far apart as practicable. In this way the danger of infection from insects is somewhat reduced. When the disease is known to be present in a field it should not be planted to this crop.

Insect Enemies.—Among the most annoying of the insect enemies we must place the cut-worm (larvæ of Noctudiæ). These insects are almost omnipresent, and when nearly full grown are liable to cut off plants that are 4 or 5 inches high. It is not common for one insect to cut off more than a single plant, but in ordinarily fertile soil there are enough cut-worms present to destroy the entire field. So that, on the whole, it becomes very annoying. Where these insects are quite destructive, it is possible to kill them with poisoned bran or poisoned cotton-seed meal, sweetened with syrup or sugar.

754. Sprays of Early Dwarf Purple Eggplant.

Another insect that does more or less damage is the cotton-boll worm (*Heliothis armigera*). This insect does its damage by boring a hole into the stems or the fruit. In the latter case it causes it to rot before it is picked, or possibly in transit. As the fruit becomes larger there is less danger of attack from this insect, so that the main trouble occurs in the earlier stages of its growth.

The Eggplant aphis (*Siphonophora cucurbitæ*) is one of the most annoying pests to this crop. It usually makes its appearance about the time the crop is fit to ship, and appears in such numbers that the plants are ruined in the course of a week or two. The insect attacks the lower surface of the leaves, making it difficult to reach the pest with insecticides, but persistent efforts and a good tobacco decoction, applied with a fine nozzle, will give considerable relief. Anthracnose (*Glœasporium melongenæ*) does not cause great damage to this crop, but is one of the agents that reduce the profits. "It may be recognized by its producing decided pits in the fruit, upon which soon appear minute blotches bordered with pink." Bordeaux mixture may be used to good advantage for preventing this disease.

Phoma Solani frequently causes damping-off in the hotbed. It often renders a whole bed worthless. Plants affected with this fungus usually fall over as if eaten off by some insect. Some plants, however, continue a miserable existence and finally die. Careful examination will reveal the point of injury, which is at the ground level. The best preventive is to use well drained beds, and then avoid excessive watering. When damping-off is detected in a seedling bed, the atmosphere and surface soil should be dried as rapidly as possible, followed by one application of fungicide. P. H. Rolfs.

EGLANTINE. *Rosa Eglanteria.* Less properly applied to *Rubus Eglanteria* and *Rosa rubiginosa.*

EGYPTIAN BEAN. Same as Black Bean, *Dolichos Lablab.*

EGYPTIAN LOTUS. See *Nymphæa Lotus;* also *Nelumbium.*

EHRÈTIA (G. D. Ehret, botanical painter, born in Germany, 1708, died in England, 1770). *Borraginàceæ.* About 50 species of tender trees and shrubs, found in the warmer regions of the world. Two species are cult. outdoors in S. Calif. and 2 others in European greenhouses. Plants with or without rough, short hairs: lvs. alternate, saw-toothed or not: fls. small, often white, in cymes, corymbs, terminal panicles, or rarely all borne in the upper axils. The 2 species described below are evergreen trees in S. Calif., attaining a height of 30 ft. Seeds may be obtained through dealers in Japanese plants.

A. *Lvs. saw-toothed.*

B. *Foliage hairy.*

macrophýlla, Wall. Lvs. ovate, acute, sharply toothed, with long, harsh, rigid hairs above and soft pubescence beneath: panicle terminal, pubescent: calyx ciliate: fr. globose, obscurely 4-grooved. Himalayas.

BB. *Foliage not hairy.*

acuminàta, R. Brown (*E. serràta,* Roxb.). Heliotrope Tree. This belongs to a different tribe of the same family with the Heliotrope, and the white fls. have a honey-like odor. Lvs. oblong-lanceolate, acuminate: panicles terminal and axillary: fls. clustered, sessile. Trop. Asia and Aust.—"Drupes red, the size of a pea; said to be edible." *E. N. Reasoner,* Oneco, Fla.

AA. *Lvs. usually not toothed.*

elliptica, DC. Tree, 15–50 ft. high: lvs. oval or oblong, sometimes saw-toothed, nearly hairless, or with minute hairs and very rough above: fr. a yellow globose drupe, the size of a small pea, with edible thin pulp. Tex., Mex. W. M.

EICHHÓRNIA (after J. A. F. Eichhorn, a Prussian). *Pontederiàceæ.* This genus includes the Water Hyacinth (see Fig. 755), the famous "million dollar weed" that obstructs navigation in the St. John's river, Florida, and is a source of wonder and delight in every collection of tender aquatics in the North. The curious bladders made by the inflation of the petioles help the plant to float freely. About flowering time the plant sends down anchoring roots which, if the water be only 3 or 4 inches deep, penetrate the soil. The true Hyacinths belong in an allied order; the Pickerel-weed, in the allied genus Pontederia, the ovary of which by abortion is 1-celled, and each cell 1-ovuled, while Eichhornia is 3-celled and many-ovuled.

The plants of this order have been greatly confused by botanists, partly because the fugacious, membranous flowers are not well preserved in dried specimens, and partly because of variation in form of leaves, depending upon whether the plants grow in deep or shallow water, or in mud. The common Water Hyacinth sends out two kinds of roots, the horizontal ones often thick and fleshy, and apparently for reproductive purposes, the vertical ones long, slender, and clothed with innumerable small, horizontal fibers. Water Hyacinths are of easy culture and are propagated by division or seed. If grown in about 3 in. of water, so that the roots may reach the soil, the petioles become elongated and the plant becomes weedy and unsatisfactory.

A. *Leaf-stalks inflated: inner perianth-segments not serrated.*

speciòsa, Kunth (*E. crássipes*, Solms. *Pontedèria crássipes*, Mart.). Fig. 755. Lvs. in tufts, all constricted at the middle, bladder-like below, sheathed, many-nerved: scape 1 ft. long, with wavy-margined sheaths at and above the middle: fls. about 8 in a loose spike, pale violet, 6-lobed, the upper lobe larger and having a large patch of blue, with an oblong or pear-shaped spot of bright yellow in the middle: stamens 3 long and 3 short, all curved upwards towards the tip. Braz. B.M. 2932, erroneously, as *Pontederia azurea*. I.H. 34: 14. A.F. 5:511. Var. **màjor**, Hort., has rosy lilac flowers. Var. **aùrea**, Hort., has yellowish flowers.

AA. *Leaf-stalks not inflated: inner perianth-segments beautifully serrate.*

azùrea, Kunth. Lvs. on long or short not-inflated petioles, very variable in size and shape: scape often as stout as the leaf-stalk, gradually dilated into a hooded spathe: fls. scattered or crowded in pairs along a stout, hairy, sessile rachis; perianth bright pale blue, hairy outside, inner segments beautifully toothed, the upper a trifle larger, with a heart-shaped spot of yellow, which is margined with white. Braz. B.M. 6487. G.C. II. 25:17. I.H. 34:20. R.H. 1890:540.—One plant will become 5 or 6 ft. across in one season.

WM. TRICKER and W. M.

ELÆÁGNUS (ancient Greek name, meaning a kind of willow; from *elaios*, olive). *Elæagnàceæ*. Shrubs or small trees: lvs. alternate, deciduous or persistent, entire or nearly so, clothed more or less with silvery or brownish scales: fls. axillary, solitary or in clusters, apetalous; perianth companulate or tubular, 4-lobed; stamens 4, included, on very short filaments: fr. a 1-seeded drupe. About 15 species in S. Europe, Asia and N. America. Highly ornamental shrubs with handsome foliage and mostly decorative frs.; the fls. are inconspicuous, but mostly fragrant. Some of the deciduous species, as *E. argentea, longipes, multiflora* and *umbellata*, are hardy North, while the evergreen ones are hardy only South. A distinct feature of some species, as *E. argentea, angustifolia* and *parvifolia*, is the conspicuous silvery hue of their foliage, while *E. longipes* is the most ornamental in fruit. They grow in almost any well drained soil, also in limestone soil, and prefer sunny position. Prop. by seeds and by cuttings of mature and half-ripened wood; also sometimes increased by layers and by root-cuttings; varieties and rarer kinds can be grafted on seedlings of vigorous growing species.

Index of names (varieties and synonyms in italics):

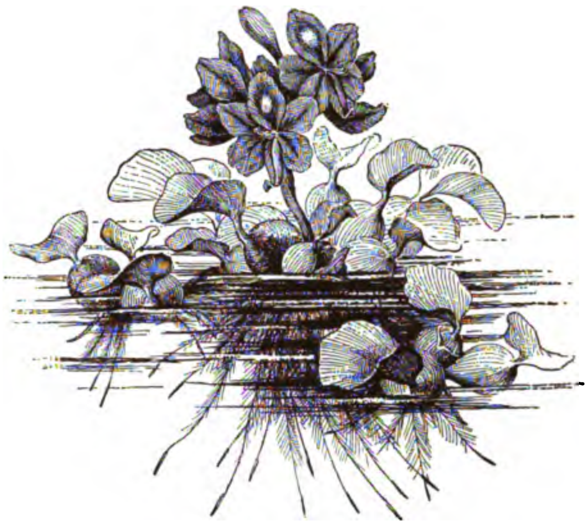
angustifolia, 1.
argentea, 6.
aureo-variegata, 8.
edulis, 5.
Frederici variegata, 8.
hortensis, 1.
Japonica, 2.
longipes, 5.
macrophylla, 7.
maculata, 8.
multiflora, 4.
orientalis, 1.
parvifolia, 2.
pungens, 8.
reflexa, 8.
Simoni, 8.
umbellata, 3.
variegata, 8.

A. *Lvs. deciduous.*

B. *Branchlets and lvs. beneath silvery white, without any brown scales.*

1. **angustifòlia**, Linn. (*E. horténsis*, Bieb.). OLEASTER. Shrub or small tree, to 20 ft., sometimes spiny: lvs. lanceolate or oblong-lanceolate, quite entire, light green above, 2–3 in. long: fls. short-pedicelled, 1–3, axillary, on the lower parts of the branches; perianth campanulate, tube about as long as limb, yellow within, fragrant; style at the base included by a tubular disk: fr. oval, yellow, coated with silvery scales. June. S. Europe, W. Asia. Var. **orientàlis**, Schlecht. (*E. orientàlis*, Linn. f.). Spineless: lvs. often oblong or oval, clothed more with stellate hairs beneath than with scales, usually glabrous above at length: fr. rather large. Var. **spinòsa**, Dipp. (*E. spinòsa*, Linn.). Spiny: lvs. linear-lanceolate or lanceolate, scaly above and densely scaly beneath: fr. smaller. L.B.C. 14:1339. B.R. 14:1156.

2. **parvifòlia**, Royle (*E. Japónica*, Hort.). Shrub or small tree, to 20 ft., with erect stems and spiny, spreading branches: lvs. elliptic-ovate or oblong-lanceolate, crisped at the margin, usually with stellate hairs above, glabrous at length, silvery beneath, 1½–3 in. long: fls. axillary, usually crowded on short lateral branchlets, short pedicelled; perianth narrow, tube longer than limb, whitish within, fragrant: fr. globose or nearly so, densely silvery when young, pink when ripe, ⅓ in. long. June. Himalayas, Japan. B.R. 29:51. Mn. 5:145.—Not quite hardy North. Sometimes cult. under the name of *E. reflexa*, which species, however, is evergreen. Var. *Japonica macrophylla* is advertised, but probably does not belong to this species.



755. Eichhornia speciosa (× 1-6).

BB. *Branchlets with reddish or yellowish brown scales and sometimes silvery besides: lvs. silvery white beneath, often with few brown scales.*

C. *Fr. juicy, scarlet-red or brownish red.*

3. **umbellàta**, Thunbg. Spreading shrub, to 12 ft., often spiny, with yellowish brown branchlets, often partially silvery: lvs. elliptic or ovate-oblong, silvery-scaly above, without brown scales beneath, crisped at the margin, 1½–3 in. long: fls. yellowish white, fragrant, axillary, 1–3 usually crowded on short lateral branchlets; tube of perianth longer than the limb: fr. globose or roundish oval, scarlet, ¼–⅓in. long, erect, rather short-stalked, clothed with silvery scales when young, ripening late in fall, while the similar *E. parvifolia* ripens much earlier. May, June. Japan. A.G. 12:206. M.D.G. 1899:569.

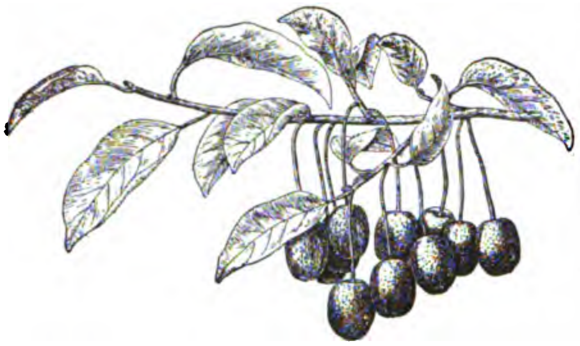
4. **multiflòra**, Thunbg. Spreading shrub, to 8 ft., spineless; branchlets reddish brown: lvs. elliptic or ovate-oblong, with scales or stellate hairs above, often glabrous at length, usually with few brown scales beneath: fls. 2–3, axillary, usually crowded on short lateral branchlets; tube longer than the limb: fr. acid, oval or roundish-oval, scarlet, ¼–⅓in. long, erect or nodding, with brown scales when young, ripening in July or August, rarely later: pedicel as long as or somewhat longer than fr. May, June. Japan. M.D.G. 1899: 569.—Very variable species, and perhaps the former and the following are only varieties of it.

5. **lóngipes**, Gray (*E. édulis*, Hort.). GOUMI. Fig. 756. Shrub, to 6 ft., with reddish brown branchlets: lvs. elliptic, ovate or obovate-oblong, with stellate hairs above, usually glabrous at length, mostly with scattered brown scales beneath, 1–2½ in. long: fls. 1–2, axillary, on the lower part of the branches or on short branchlets, yellowish white, fragrant; tube as long as the limb: fr. pendulous, oblong, ¾ in. long, scarlet, on slender peduncles, much longer than the fr.; fr. with brown scales when young, ripening in June or July, of agreeable, slightly acid flavor. April, May. Japan, China. B.M. 7341 (as *E. multiflora*). G.F. 1:499. G.C. 1873:1014. Gng. 1:275, 277.

CC. *Fr. rather dry, silvery white.*

6. **argéntea**, Pursh. Erect shrub, to 12 ft., spineless, stoloniferous, with reddish brown branchlets: lvs. ovate

or oblong-lanceolate, silvery on both sides, often with scattered brown scales beneath, 1–3 in. long: fls. 1–3, axillary, yellow within, fragrant: fr. oval or roundish oval, densely clothed with silvery scales, short-pedicelled, ⅓–⅜in. long. May, June. Canada, south to Quebec, Minnesota, Utah. B.B. 2:467.



756. Elæagnus longipes (× ½).

AA. *Lvs. evergreen: usually flowering in fall.*

7. **macrophýlla,** Thunbg. Spineless shrub, to 6 ft., with silvery white branchlets: lvs. broad-ovate or broad-elliptic, on stout and rather long petioles, scaly above, usually glabrous at length, silvery white beneath: fls. axillary, with silvery and brownish scales outside; tube companulate, abruptly narrowed at the base, as long as limb. Japan.

8. **púngens,** Thunbg. Spreading shrub, to 6 ft., mostly spiny, with brown branchlets: lvs. oval or oblong, undulate and often crenulate at the margin, at length glabrous above, silvery beneath, more or less interspersed with brown scales, 2–4 in. long: fls. in axillary clusters; tube cylindrical, slightly narrowed at the base, longer than the limb: fr. short-stalked, about ¾in. long, with silvery and brown scales. Japan. Var. **Fréderici variegàta,** Hort. Lvs. with yellow center and green margin. Var. **maculàta,** Hort. With large yellow blotches. A. G. 13:122. Var. **Simoni,** Hort. Lvs. rather large, oblong-elliptic, with few brown scales beneath or nearly without. Var. **Simoni tricolor,** Hort. Lvs. like the former, but variegated with yellowish and pinkish white. Var. **refléxa,** Hort. Branches spineless, elongated and flexile: lvs. with scattered brown scales beneath. Var. **variegàta,** Hort. Lvs. margined yellowish white. Var. **aúreo-variegàta,** Hort., probably belongs here.

E. ferruginea, A. Rich. Spineless evergreen shrub, with spreading brown branches: lvs. with yellowish and brown scales beneath; perianth with quadrangular, abruptly contracted tube: fr. long-stalked. Japan.—*E. glàbra*, Thunbg. Spineless evergreen shrub, with brown branches: lvs. shining above, with yellow and brown scales beneath: perianth with slender, tubular tube, gradually narrowed toward the base, twice as long as the limb: fr. short-stalked. Japan.—*E. refléxa*, Morr. & Decne. (E. glabra × pungens). Evergreen shrub, with brown branches: lvs. glabrous above, whitish beneath, densely interspersed with yellowish and light brown scales, giving the under surface a bronzy golden hue: perianth with slender tube: fr. short-stalked. Japan.—*E. refléxa*, Hort.=E. pungens var. or E. parvifolia.

ALFRED REHDER.

ELÆIS (Greek, *olive*). *Palmàceæ*, tribe *Cocoìneæ*. Tropical spineless palms with pinnate foliage, of which the best known is the Oil Palm of western Africa, whose red fruits, borne in large clusters, yield the palm oil of commerce, which is used in making candles and soap. Young plants are grown for ornament in S. Calif., and under glass North. The other 6 species are from tropical S. America. The genus is separated from Cocos by the 1-3-seeded fruits, with 3 pores above the middle.

Guineénsis, Jacq. OIL PALM. Stems stout, 20–30 ft., coarsely and deeply ringed: leaves 10–15 ft.; petiole spiny-serrate; leaflets linear-lanceolate, acute, the same color above and below. F.S. 14:1492.—*Elæis Guineensis*, from an early stage in growth, is one of the most ornamental palms. Until it reaches several feet in height it is a slow grower, consequently we do not see much of it, except in collections. It does best in a warm temperature, although it will thrive in an intermediate house. Seeds are always obtainable from several of the large European houses. It is but little grown as a commercial palm, as young plants do not show their full character. Given same treatment as *Areca lutescens*, will grow well. This treatment includes night temperature of 65° and plenty of water.

JARED G. SMITH, G. W. OLIVER and W. H. TAPLIN.

ELÆOCÁRPUS (Greek, *olive-fruit*). *Tiliàceæ*. This genus includes a tender evergreen flowering shrub of very distinct appearance. The creamy white petals, charmingly fringed, the bright red sepals and pedicels, and the mass of yellow stamens are the chief features. The racemes contain 2–5 pendulous flowers, which are about half an inch across, and fragrant. This plant was once advertised by Pitcher and Manda, and may exist in a few choice collections. The genus has about 50 species, all from tropical Asia, Australia and the Pacific isles. In the tropics they are trees, with alternate, rarely opposite lvs., which are entire or saw-toothed, and in some species sparingly spotted with black beneath: fls. axillary, in racemes; petals glabrous or silky: drupes oblong or globose.

grandiflòrus, James Smith. A much-branched shrub, about 7 ft. high under glass: lvs. considerably clustered at the ends of branches, 3–6 in. long, broadly lanceolate; petiole a fourth to 1 in. long, with a few distant saw-teeth, or more or less round-toothed or wavy-margined: sepals 5, red outside, white inside; petals 5. Java. B.M. 4680.—Lvs. rather leathery, dark green above, paler beneath. Warmhouse. Prop. by cuttings of nearly ripened wood. Not common.

E. cyàneus, Sims, named for its blue fruits (which are not known in cultivation), has broader and less tapering lvs., with more numerous teeth, and membranous texture, and the sepals are white outside. Australia. B.M. 1737.

W. M.

ELÆOCÓCCA is all referred to *Aleurites cordata*.

ELÆODÉNDRON (Greek for *olive tree*, from the resemblance of the fruit to that of the olive). *Celastràceæ*. Perhaps 40 species of shrubs or small trees in tropical countries, chiefly in the Old World tropics. Lvs. simple, entire or crenate, opposite or alternate, thickish, frequently evergreen: fls. inconspicuous, greenish or white, in axillary clusters; calyx 4–5-parted; petals 4–5, and exceeding the calyx; stamens 4–5: ovary single, surrounded by a fleshy ring: fruit a small fleshy drupe. Certain plants which, before they had bloomed, were referred to Aralia, are now known to belong to this genus, representing a distinct natural family. Culture of Aralia.

orientàle, Jacq. (*Aràlia Chabrièri*, Hort.). A most graceful and handsome plant, with linear-lanceolate alternate, shining, drooping leaves, 10–12 in. long, and with a reddish rib. Madagascar, Mauritius. R.H. 1891, p. 224. A.F. 10:1041.—Holds its lower foliage well, or throws out new foliage to take the place of that which drops. In the early descriptions, the plant was said to have pinnately compound lvs., but what were taken for leaflets are really lvs. Still a rare and choice plant in this country. Thrives in either an intermediate or a warm house. Prop. by single-eye cuttings in small pots, kept rather warm. See, also, p. 87.

austràle, Vent. Int. into S. Calif. from Australia, and prized for its holly-like foliage. In its native habitat it is a tree 30–40 feet high, producing useful close-grained wood.

L. H. B.

ELAPHOGLÓSSUM. See *Acrostichum*.

ELDER and **ELDERBERRY.** See *Sambucus*.

ELECAMPANE. *Inula Helenium*.

ELECTRO-HORTICULTURE is a term used by Siemens to designate the application of the electric light to the growing of plants. The term is an unfortunate one, since the use of electric light is not an application of electricity itself to plant-growing, but is merely a device for securing illumination. Any strong artificial light hastens assimilation, and thereby causes plants to grow more rapidly. The practical questions to be considered are, therefore, the expense of using the light and determining whether there are injurious elements in the spectrum of the given light.

The spectrum of the electric arc light is the spectrum of carbon plus that of certain gases incident upon combustion. The spectrum of the arc light is rich in rays which lie beyond the luminous part, and these rays are very injurious to most plants. These rays of the ultra-violet part of the spectrum are eliminated by a plain glass, so that when the electric light is surrounded by a globe, or when the light is hung above the roof of the greenhouse, the injuries are reduced to a minimum. Long-continued experiments at Cornell University have shown that each kind of plant behaves in its own way in the presence of electric light. It is not possible to prophesy what the results may be in a given species. A few plants, as tomatoes, English cucumbers, and carrots, seem to be very little affected either injuriously or beneficially. Nearly all flowers are hastened into bloom by the influence of the light, and their colors are often brighter than under normal conditions; but in many instances they do not last so long. The best results are secured if the light is applied to the plants when they have reached nearly or quite their full stature. If applied very early in thoir growth, they tend to make flowers before the plant has attained sufficient size. In floriculture, therefore, the chief practical value of the electric arc light seems to be its influence in hastening the flowering of certain plants in dark climates, or when plants must be had for a definite season. For instance, if the light is applied to Easter lilies for a month before their normal blooming time, the period of bloom may be hastened from four to ten days.

Lettuce has shown greater beneficial results from the application of the electric light than any other plant with which careful experiments have been made. Lettuce which receives light from the arc lamp for half of each night may be expected to reach marketable size from one to two weeks before the normal crop.

As a rule, better results are secured when the light runs only half the night. A common two-thousand candle-power light has a marked effect on the growth of many plants at a distance of sixty to even one hundred feet. The incandescent light has a similar influence, but not so marked. The incandescent or Welsbach gas light is also capable of hastening the growth of plants.

As now understood, the application of the electric light to the growing of plants is a special matter to be used when the climate is abnormally cloudy or when it is desired to hasten the maturity of crops for a particular date. Only in the case of lettuce has it been proved to be of general commercial importance; and even with lettuce, it is doubtful if it will pay for its cost in climates which are abundantly sunny. For the literature of the subject, consult the publications of the Experiment Stations of Cornell University and of West Virginia.

L. H. B.

ELEÓCHARIS (Greek-made word, meaning *delighting in marshes*). *Cyperàceæ*. Rush-like native plants, mostly of low, wiry growth, and commonest in marshes and on muddy shores. They are mostly perennial. The culms are simple, terete or angular, bearing a spherical or oblong head of inconspicuous fls.: lvs. usually reduced to mere sheaths. They are interesting for the borders of ponds, and are very easy to naturalize. Three species have been offered by collectors: **E. equisetoides**, Torr. A shore plant, with terete hollow culms 2–3 ft. high, and cylindrical heads about the thickness of the culm; resembles horse-tail (Equisetum). **E. aciculàris**, R. Br. Hair-like, 6 in. high, making grass-like mats. **E. ovàta**, R.Br. Culms nearly terete, 12 in. high: head globose or ovate.

L. H. B.

ELEPHANT'S EAR is a name for Begonias. The Elephant-Ear Caladium is a Colocasia.

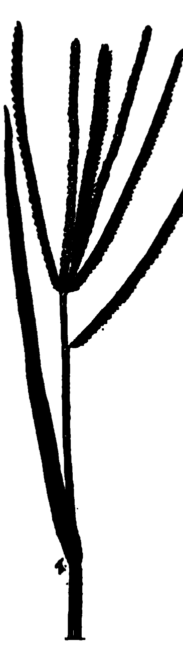
ELEPHANT'S FOOT. *Testudinaria*.

ELETTÀRIA (native name). *Scitaminàceæ*. Differs from Amomum in technical characters, as in the slender tube of the perianth, the presence of internal lobes in the perianth, and the filaments, not prolonged beyond the anther. Perhaps only 2 species, although more have been described. **E. Cardamòmum**, Maton, affords the small Cardamons of commerce, which are the dried capsules, and which are used in medicine. The large or China Cardamons are from species of Amomum. The Cardamons of Nepal and Bengal are Amomum; those of S. India are Elettaria. The Elettaria is native to India, but is cult. in Jamaica, and it will no doubt thrive in parts of S. Fla. Plants have been offered by Reasoner Bros. The Cardamon plant grows 5–10 ft. high, bearing an erect, jointed, closely sheathed stem, and lanceolate acuminate entire nearly sessile lvs. often 2 ft. long: fls. purple-striped. It is said to prefer shade and a moist soil. In three or four years plants give full crops, but they become more or less exhausted after bearing three or four crops. Prop. by dividing the roots and by seeds. Under glass, handled the same as Alpinia.

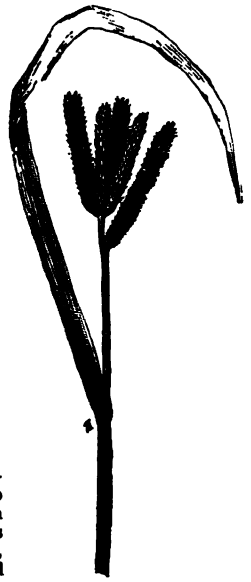
L. H. B.

ELEUSÌNE (Greek, *Eleusis*, the town where Ceres, the goddess of harvests, was worshipped). *Gramíneæ*. CRAB GRASS. YARD GRASS. Coarse, tufted annuals, with the stout unilateral spikes digitate at the apex of the culm. Spikelets several-fld.; arranged in two rows along one side of a continuous rachis, rachilla articulate above the empty glumes: fls. perfect or the upper one staminate: grain loosely enclosed by the fl.-glume and palet. Species 5 or 6 in tropical regions of the Old World. Some are valued as cereals in Africa, India, and some other eastern countries. For *E. Ægyptìaca*, see *Dactyloctenium*.

Ìndica, Gærtn. DOG'S TAIL. WIRE GRASS. Fig. 757. Erect, 2–4 ft. high; culms ascending, flattened: spikes 5–7, about 2–4 in. long, digitate, often with one or two lower down: spikelets 3–6-fld. Blooms from June to October.—A very common grass in cultivated fields and dooryards in the South, often troublesome as a weed on lawns.



757. Eleusine Indica. (× ½.)



758. Eleusine coracana. (× ½.)

coracàna, Gærtn. AFRICAN MILLET. Fig. 758. Erect, 2–4 ft high, closely related to and much resembling *E. Indica*. Can be distinguished from it by its stouter habit, shorter, broader and larger spikes.—Cult. in India, China and Japan for the grain. Beer is brewed from the grain in Abyssinia. In cult. in America as an ornamental grass. Coracana means "of the crows."

Barcinonénsis, Costa. Culms tufted, 6 in. to 1 ft. high: leaf-blades short, about one-sixteenth of an in.

wide, obtuse at the apex: spikes broad, 2–4, digitate, 1–1½ in. long; spikelets closely imbricate, 5-fld.—Int. into Amer. on ballast, and in cult. as an ornamental plant. P. B. KENNEDY.

759. Winter bud of Elodea. Nat. size.

ELEUTHEROCÓCCUS (Greek, *eleutheros*, free, and *kokkos*, kernel; the seeds are easily detached from the flesh). *Araliàceæ*. Ornamental hardy shrubs, with numerous erect, spiny stems, rather large, digitate lvs., inconspicuous greenish fls., and black berries in umbels. They prefer a somewhat moist and rich soil, and are well adapted as single specimens on the lawn or in borders of shrubberies for the handsome bright green foliage. Prop. by seeds and root-cuttings. Three species in E. Asia, with alternate, long-petioled, digitate lvs.: fls. small, greenish, polygamous-diœcious, 5-merous, pedicelled, in terminal, peduncled umbels: berry roundish oval, black, shining, 5-seeded.

senticòsus, Maxim. Shrub, to 15 ft., the branches densely covered with slender spines: lfts. 5, rarely 3, oblong, usually narrowed at the base, acute, sharply and doubly serrate, sparingly hispid above, with bristly hairs on the veins beneath, 4–6 in. long: fr. about ⅓ in. high. July. N. China. Gt. 12:393. ALFRED REHDER.

ELIOT, JARED, author of the first American book on agriculture, was born November 7, 1685, and died April 22, 1763. He was the grandson of John Eliot, the "apostle of the Indians," and was pastor at Killingworth, Conn., from October 26, 1709, until his death. He was a botanist, and the leading consulting physician in New England. He introduced the mulberry tree into Connecticut, wrote an essay upon the silkworm, and discovered a process of extracting iron from ferrugineous sands. His "Essays upon Field-Husbandry," begun in 1748, formed the first American book devoted exclusively to agriculture. It is now extremely rare. He was a high-minded, progressive and useful citizen. Many of his sermons were separately reprinted. Jared Eliot and Samuel Deane were among the few agricultural writers of note in the period before American horticulture was considered distinct from agriculture. W. M.

ELLIÓTTIA (after Stephen Elliott, South Carolina's early and excellent botanist. For a fine portrait and sketch of him, see G.F. 7:204–206). *Ericàceæ*. A genus allied to Rhododendron and Ledum, with three species, of which the most interesting is an extremely rare native southern shrub, with delicate white flowers, an inch in diameter, composed of 4 slender petals, and borne in racemes 6–10 in. long. John Saul once advertised it, and P. J. Berckmans, of Augusta, Ga., still cultivates it. The two Asiatic species are inferior in size and beauty of flowers. Important generic characters which distinguish this genus from Leiophyllum and Cladothamnus are: flowers terminal, racemose; petals 3–5, entire: anthers 4–10, opening by irregular cracks: ovary 3–5-celled.

racemòsa, Muhl. Shrub, 4–10 ft. high, branches slender: lvs. alternate, oblong, acute at both ends, glandular-mucronate, entire, thin, membranous, 3–4 in. long, 1–1½ in. wide; petioles slender, grooved, hairy, about 1 in. long: calyx lobes 4, short, rounded: stamens 8: fr. unknown. Wet, sandy woods of S. C. and Ga. G.F. 7: 205. W. M.

The plants formerly offered by John Saul were incorrectly named, and he refunded whatever amount had been charged for all plants sold by him. They proved to be *Styrax grandiflora*. The only plants now known to exist are a few specimens collected by the writer, in company with Dr. Asa Gray in 1873, in a patch in Columbia county, Ga., which covered an area of about 3 acres. This was afterwards cleared, and not a vestige of Elliottia remains. A small patch is said to exist in Edgefield county, S. C., near the city of Augusta, Ga., but all my efforts to find it have failed.

The only plants which the writer has ever been able to propagate came from suckers. A few of these were sent to the Arnold Arboretum and to Kew Gardens. No seed has ever been produced upon our specimens, which are now 15 feet high. P. J. BERCKMANS.

ELM. See *Ulmus*.

ELODÈA (Greek, *marshy*). *Hydrocharidàceæ*. This genus contains perhaps 9 species of aquatic herbs, including the Ditch-moss, an interesting hardy perennial plant found in slow streams and ponds nearly throughout North America, except the extreme north. It is particularly desirable for home and school aquaria. It is a slender, wholly submerged plant, with branching stems 4 in. to 3 ft. long, according to the depth of the water. The pistillate fls. are raised to the surface by their long calyx tubes, and float there. The minute staminate fls., which are rarely seen, commonly break off below, rise to the surface, float about, open, and shed their pollen. The fruit ripens below the surface, and the seeds rise. This plant is now found abundantly in Europe, being sometimes known in England as "Babington's Curse," from the man who introduced it. It reached England in 1841 and choked up many canals and waterways, notably the Cam. It was very abundant in 1852 and 1853, but declined in the next few years. Ducks, geese and swans are fond of it, and render great service in getting rid of it. It can be used for manure where it grows in sufficient quantities. Like many other water plants, it makes heavy buds in the fall (Fig. 759), which drop to the bottom and grow in the spring.

Canadénsis, Mich. (*Anácharis Canadénsis*, Planch. *A. Alsinástrum*, Bab.). WATER-WEED. DITCH-MOSS. WATER THYME. WATER PEST. Lvs. in whorls of 3 or 4, or the lower ones opposite, linear, minutely toothed or not, 2–7 lines long, ½–2 lines wide: fls. white; calyx tube of the pistillate fls. 2–12 in. long; spathes 5–7 lines long. B.B. 1:93. W. M. TRICKER and W. M.

ELÒDES. See *Hypericum*.

ELSHÒLTZIA (John Sigismund Elsholtz, author of an unpublished Flora Marcica, the MS. of which is in the Royal Library, Berlin) *Labiàtæ*. Herbs or undershrubs, in temperate and tropical Asia, with fls. in spikes: calyx tubular, 5-toothed; corolla oblique or 2-lipped, the upper lip 4-toothed in the typical species (described below), the lower longer and entire or somewhat crenulate; stamens 4, separated. One is in the Amer. trade.

760. Elsholtzia cristata.

cristàta, Willd. Fig. 760. Twelve to 18 in. high, with opposite, petioled, ovate-oblong toothed lvs. and small, light blue fls. in crowded, more or less 1-sided spikes: calyx enlarging in fr. Asia. B.M. 2560.—Hardy annual, with very aromatic foliage and attractive, upright habit. Said to be a good bee plant. L. H. B.

ÉLYMUS (Greek, *rolled up* or *enveloped*). *Gramineæ*. Lyme Grass. Wild Rye. Erect perennial grasses, with flat or convolute lvs. and closely-fld. terminal spikes: spikelets 2–6-fld., often long-awned, the uppermost imperfect, sessile, in pairs (rarely in 3's or 4's), at the alternate notches of the continuous or articulate rachis, forming terminal spikes; empty glumes acute or awn-pointed, persistent and subtending the fls. like an involucre. Species about 20, in the temperate regions of Eu., Asia and N. Amer. For *E. Hystrix*, see *Asperella*.

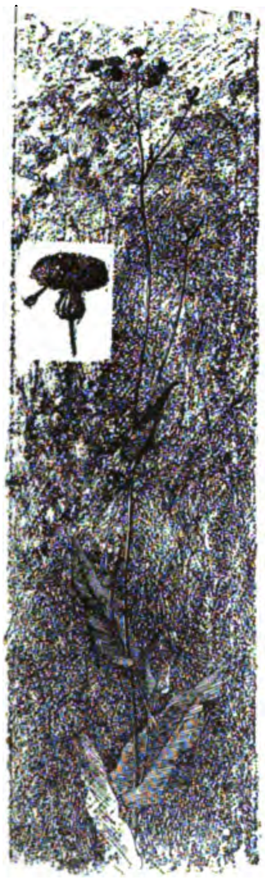
arenàrius, Linn. Sea Lyme Grass. Stout, coarse perennial, 2–8 ft. high, with strong, creeping rootstocks: lvs. long, rigid, smooth: spikes dense, terminal, 6–12 in. long; spikelets about 1 in. long and 3–4-fld.—One of the best grasses known for binding the drifting sands of our Atlantic and Pacific coasts, especially when combined with Beach Grass (see *Ammophila arenaria*). The seed is also used by the Digger Indians for food.

Canadénsis, Linn. Canada Lyme Grass. Terrel Grass. Rather stout, smooth perennial, 3–5 ft. high, with broad, flat lvs. 6–12 in. long: spikes 4–9 in. long, exserted, nodding; spikelets very rigid, 3–5-fld.: fl.-glumes long-awned. Common in low thickets and along streams in rich, open woods throughout the country.—Cult. as an ornamental plant. Var. **glaucifòlius**, Gray (*E. glaucifòlius*, Hort.), is pale and glaucous throughout, with usually more slender awns. Cult. as an ornamental grass.

condensàtus, Presl. Giant Rye Grass. The largest of the native Rye Grasses, growing to the height of 5–10 ft.: culms in dense tufts, stout: spikes 8 in. to 1½ ft. long, very variable, compact or interrupted, bearing branching clusters of spikelets at each joint. Common in the Rocky mountain regions and the Pacific slope.—Useful for binding the loose sands on railway banks. Cult. as an ornamental grass.

glaùcus, Regel. A glaucous-leaved, dense, cespitose, hardy perennial grass 3–4 ft. high, with very short, smooth lvs. and erect, elongated spikes: spikelets in 2's, erect, usually 5-fld., densely villous-pubescent, short-awned. Turkestan.—Rarely in cult. as an ornamental grass. P. B. Kennedy.

EMÍLIA (perhaps a personal name). *Compósitæ*. Herbs, perennial or annual: related to Senecio, but always without rays: heads rather small, the involucre very simple and cup-shaped, with no small outer scales: akenes with 5 acute ciliate angles: florets all perfect. A dozen or more species have been described from Africa, tropical Asia and Polynesia. One species in common cult.



761. Emilia flammea.
Separate head × ⅓.

flámmea, Cass. (*E. sagittàta*, DC. *E. sonchifòlia*, Hort., not DC. *E. sonchifòlia*, Linn., var. *sagittàta*, Clarke. *Cacàlia coccínea*, Sims, B.M. 564. *C. sonchifòlia*, Hort., not Linn. *C. sagittàta*, Vahl. *Senècio sagittàtus*, Hoffm.). Tassel Flower. Flora's Paint Brush. Fig. 761. A neat annual, erect, 1–2 ft., glabrous or sparsely hairy, the long stems terminated by clusters of small scarlet (golden yellow in the form called *Cacàlia lùtea*, Hort.) heads: lvs. lance-oblong or ovate-lanceolate, clasping the stem, remotely crenate-dentate: involucre scales much shorter than the florets. E. Ind., Philippines.—This much-named annual is one of the commonest garden flowers. It is of the easiest culture in any good soil. Blooms from July until frost, if sown as soon as weather is settled.

E. purpùrea, Cass. (E. sonchifolia, DC., not Hort. Cacalia sonchifolia, Linn. Senecio sonchifolia, Mœnch). Radical lvs. often more or less lyrate, stem lvs. broader and clasping, the heads fewer in the cluster and the involucre scales nearly as long as the florets. Apparently not in cult. in this country.

L. H. B.

ENCÈLIA (meaning obscure). *Compósitæ*. About 20 species of American herbs, chiefly western, often woody at base. The following was introduced by Franceschi, Santa Barbara, Calif., and has fls. 2½ in. across, with yellow rays and a black disk. Has probably never been tried in the East.

Califórnica, Nutt. Woody at base, 2–4 ft. high, strong-scented, rather hoary, or becoming green: lvs. 1–2 in. long, ovate to broadly lanceolate, usually entire, indistinctly 3-ribbed from the base, abruptly stalked: rays numerous, 2–4-toothed: seeds obovate, with long, silky hairs on the callous margins and a shallow notch at the tip.

EMMENÁNTHE (Greek, *enduring flower;* the persistent corollas retain their shape when dry like everlasting flowers). *Hydrophyllàceæ*. Half a dozen annual herbs from western North America, of which the most interesting species was introduced to cultivation in 1892, under the name of California Yellow or Golden Bells. It grows 9–12 in. high, forming bushy plants, each branch loaded with broadly bell-shaped, pendulous, unwithering flowers, about half an inch long, of creamy yellow. The general effect of a branch suggests the lily-of-the-valley, but the foliage is pinnatifid. The lasting character of the fl. distinguished the genus from its allies, the nearest of any garden value being Phacelia. Corolla lobes 5; stamens 5; style 2-cut. The species named below belongs to a section of the genus, with calyx lobes broader downward, and coarsely pitted seeds. All the others have the calyx lobes broader upwards and the seeds more or less wrinkled transversely.

penduliflòra, Benth. California Yellow or Golden Bells. Somewhat sticky, with long or short, soft hairs: lvs. pinnatifid, lobes numerous, short, somewhat toothed or sharply cut: ovules about 16: seeds 1 line long. Calif. G.C. III. 11:339. W. M.

EMPÈTRUM (Greek, *en*, in, *petros*, rock; growing often on rocks). *Empetràceæ*. Crowberry. Evergreen, hardy, prostrate or creeping, heath-like shrubs, with small, crowded lvs., inconspicuous purplish fls., and globose, red or black, edible berries. They grow best in moist, sandy or peaty soil, and are especially handsome for rockeries. Prop. usually by cuttings of nearly ripened wood in late summer under glass. One species through the northern hemisphere in mountainous and arctic regions, also in S. America. Lvs. generally linear, thick, alternate: fls. diœcious, small, 1–3 axillary, nearly sessile, 3-merous: fr. a 6–10-seeded drupe.

nigrum, Linn. Lvs. linear to linear-oblong, glabrous or nearly so, entire, ⅛–¼ in. long: fls. purplish: fr. black, about one-fifth in. in diam. Var. **purpùreum**, DC. Fr. red. Arctic and boreal N. Am. Var. **rùbrum**, DC. (*E. rubrum*, Vahl). Young branches and margins of lvs. villous, hence the plant grayish green: fr. red. Antarctic S. Am. B.R. 21:1783. Alfred Rehder.

ENCEPHALÁRTOS (Greek, *en*, within, *kephale*, head, and *artos*, bread; alluding to the bread-like interior of the trunk). *Cycadàceæ*. Grand cycads from tropical and southern Africa, grown chiefly for their splendid evergreen foliage. Nineteen or less species. The finest picture of an Encephalartos in any American periodical is probably that in Garden and Forest 4:209, accompanying an article from William Watson, of Kew, whose remarks are here condensed. These plants are specially suited for large conservatories, the fronds being not easily injured. They should succeed outdoors South. Some of the Kew specimens must be nearly a century old. The trunks of some kinds grow only a few inches in many years. The specimen illustrated had a stem 5 ft. in circumference, nearly 3 ft. high, and crowned by 107 leaves, each 3 ft. long, and rigid. A whorl of new leaves is produced each year, the latest one having 34 full sized leaves. The whole head was about 7½ feet in diameter. Most kinds prefer a sunny, tropical house, but *E. brachyphyllus* and perhaps others may be grown in a cool greenhouse if kept a little dry in winter. The cones are always interesting and often very decorative. Those of *E. villosus* are twice as large as a pineapple, orange-yellow, half-revealing the scarlet fruits.

Cycads are propagated by seeds; also by offsets or suckers. They are slow-growing, except in very warm houses. They like a strong, loamy soil. While making new growth they need plenty of water. See *Cycas*. The woolliness of the stem and leaf-segments varies with the age of the plants and of the leaves.

The pith and central portion of the cones of some species form an article of food among the Kaffirs, hence the common name of Kaffir Bread. The most widely known species in cultivation are *E. villosus*, *E. Altensteinii* and *E. pungens*. Though very handsome Cycads, they are by no means popular.

Some other Cycads frequently produce seed in conservatories, but Encephalartos seldom does, and plants are, therefore, usually imported. Dry trunks, weighing frequently from 50–75 pounds, have been received from South Africa. They often remain dormant for a year or more, and do not make ornamental specimens for two or more years.

In the following descriptions "rachis" refers to the midrib of the leaf on which the leaflets or segments are borne, and "petiole" means the portion of the leaf below where the leaflets begin.

A. *Leaflets toothed (sometimes entire in No. 1).*

B. *Petiole 4-angled: foliage glaucous, i. e., covered with plum-like "bloom."*

1. **hórridus,** Lehm. Trunk woolly or not: leaflets opposite or alternate, lanceolate, mostly entire, sometimes toothed. Var. **glaúca** is presumably more glaucous than the type. B.M. 5371.

BB. *Petiole sub-cylindrical: foliage not glaucous.*

C. *Leaves dark green: trunk not woolly.*

2. **Altensteinii,** Lehm. Leaflets mostly opposite, lanceolate. B.M. 7162–3. G.C. II. 6:392, 393, 397; III. 2:281; 12:489–93.

CC. *Leaves light green: trunk woolly.*

3. **villòsus,** Lehm. Leaflets opposite or alternate, linear-lanceolate. B.M. 6654. R.H. 1897:36. G.C. II. 1:513; 3:400; 7:21; 13:181.

AA. *Leaflets not toothed (except in young lvs. of Nos. 8 and 9, and also in No. 1).*

B. *Foliage glaucous.*

4. **Léhmanni,** Lehm. (*Cỳcas Léhmanni*, Hort.). Trunk not woolly: rachis and petiole obtusely 4-angled; leaflets nearly opposite, narrowly or broadly lanceolate, rarely 1-toothed. Gt. 1865:477.

BB. *Foliage not glaucous.*

C. *Apex of leaflets mostly obtuse, pointless.*

5. **longifòlius,** Lehm. Trunk not woolly, at length tall: rachis and petiole 4-cornered but flattish above: lowest leaflets often 1–3-toothed, margin somewhat revolute: wool soon vanishing from the rachis and leaflets. Var. **revolùtus,** Miq., has the margins more distinctly revolute. Var. **angustifòlius** has narrower, flat leaflets. Var. **Hoòkeri,** DC., has narrowly lanceolate leaflets, not glaucous but intense green, and rachis not woolly. B.M. 4903, erroneously named *E. Caffer*, is referred to this place by a recent specialist, though the leaflets are distinctly pointed in the picture.

CC. *Apex of leaflets always strong-pointed.*

D. *Form of leaflets linear.*

E. *Margin of leaflets revolute.*

6. **cycadifòlius,** Lehm. (*E. Friderici-Guiliélmi*, Lehm. *E. cycadifòlius*, var. *Friderici-Guiliélmi*, Rod.). Trunk woolly at first: rachis and petiole ashy-pubescent: leaflets opposite and alternate, linear. I.H. 29:459. G.F. 4:209.

EE. *Margin of leaflets not revolute.*

7. **púngens,** Lehm. (*Zàmia púngens*, Ait.). Rachis and petiole glabrous: leaflets long-linear, dark green, rigid, flat, striated beneath. Var. **glaúca** is also sold.

DD. *Form of leaflets lanceolate.*

E. *Rachis glabrous.*

8. **Cáffer,** Miq. (*E. Cáffra*, Hort.). Petiole 3-angled: leaflets alternate, narrower at the base, twisted, the younger ones with 1 or 2 teeth. R.H. 1869, p. 233. Not B.M. 4903, which is *E. longifolius*, var. *Hookeri*.

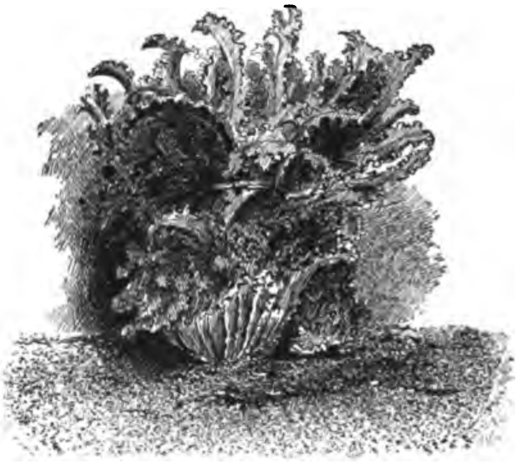
EE. *Rachis spidery-pubescent.*

9. **Cáffer,** var. **brachyphýllus,** DC. (*E. brachyphýllus*, Lehm.). Rachis and blades of the lower leaflets spidery-pubescent: male cones sessile instead of peduncled. The pinnæ are erect, and longer and narrower than in *E. Caffer*.

W. M., P. J. BERCKMANS and W. H. TAPLIN.

ENCHOLÍRIUM. Consult *Tillandsia*.

ENDIVE (*Cichòrium Endívia*). *Compósitæ.* See *Cichorium*. During summer and fall, well-blanched heads of Endive may be found in all our large city markets, and are appreciated to some extent, especially among the foreign part of our population. We seldom see Endive in American home gardens, or in small local markets. In the absence of lettuce during the latter part of the season, Endive serves as an acceptable salad, and is well worthy of greater attention than it receives, especially as it is of easy culture. Select any ordinary good garden soil. Sow seed thinly in drills, which need not be more than a foot apart, but thin the plants promptly to about the same distance in the rows, and keep free from weeds, and also well cultivated and hoed. When the plants have attained nearly their full growth, gather up the leaves and tie them lightly at their tips (Fig. 762). In from two to three weeks' time, according to weather conditions, the heart will blanch beautifully, and the plant should then be promptly used or marketed, as decay sets in soon after this stage of development. The blanching may also be done by slipping a large-sized but short tile or piece of tile over each plant, after the leaves are gathered up and held closely together.



762. Green Curled Endive tied up for blanching.

The varietal differences are slight, and consist mostly in variations of form of leaves. The standard variety grown in America is called Green Curled. In European catalogues we find a number of varieties listed and described. Among them Moss Curled, Rouen, and Broad-leaved are the most popular. T. GREINER.

ENEMIES. This word is found increasingly useful to include the work of Insects and Diseases, which see. Also consult *Spraying* and *Tools*.

ENKIÁNTHUS (Greek words, referring to shape of the Andromeda-like flowers). Also written *Enkyanthus*. *Ericàceæ*. A genus of 5 species of shrubs, allied to our familiar Andromeda, Zenobia and Pieris (the last of which it most resembles in habit), and distinguished from these genera by the obtuse anthers, 2-horned at the top on the back, and long pores: seeds 3–5-winged. China, Japan and Himalayas. *E. Japonicus* is very showy in autumn, with its brilliant yellow foliage more or less marked with red, and its strongly contrasting black berries. In early spring it bears numerous umbels of Andromeda-like fls. Pot-grown plants are obtained through dealers in Japanese plants. The species is hardy as far north as Washington, D. C., and perhaps farther. Enkianthus is a genus of glabrous shrubs: branchlets somewhat whorled: buds furnished with deciduous bracts: lvs. stalked, leathery and evergreen or membranous and deciduous, entire or minutely toothed: fls. in terminal umbels, white, rosy or scarlet, drooping or merely nodding; calyx small, 5-cut; corolla urceolate or broadly bell-shaped, with 5 spreading or reflexed lobes; stamens 10: ovary 5-celled. Four kinds are grown abroad under glass. Equal parts of loam and peat, and careful potting, are advised. Prop. by cuttings of ripe wood, inserted under glass in spring without heat; also, by layering out of doors.

Japónicus, Hook. Lvs. crowded at the ends of branchlets, 1½–2 in. long, short-stalked, obovate when young, ovate when older, acute, serrulate, deciduous: fls. drooping, pure white; pedicels 8 lines long, glabrous; corolla globose, with 5 sacs at the base, a contracted mouth, and 5 small, revolute lobes: capsule narrow, erect. Japan. B.M. 5822. R.H. 1877, p. 467. G.C. III. 21:357.

E. campanulàtus, Nicholson. Fls. axillary, drooping, in short racemes, dark red throughout, without sacs at the base; pedicels sometimes minutely hairy, 6–9 lines long; corolla 4 lines across, with 5 erect lobes. In the forests of Japan sometimes 30 ft. high. Has brilliant foliage. Northern Jap. B.M. 7059.—*E. Himalàicus*, Hook. Lvs. 2–3 in. long, narrower above the middle and more tapering than in E. Japonicus, and acuter at the base, pubescent beneath when young: fls. drooping, 6–14 in an umbel; pedicels hairy: corolla dull yellowish red, streaked brighter red, without sacs at the base, and erect lobes. B.M. 6460. R. H. 1888, p. 512. The bright red petioles and leaf-margins are possessed to a lesser degree in the next species, but this has yellowish pedicels and the next species red ones.—*E. quinqueflòrus*, Lowe. Lvs. longer petioled than in the rest, oval, and more abruptly pointed; calyx colored like the corolla instead of green, as in the other kinds: fls. drooping, scarlet, sometimes white at tips, with 5 sacs, which are shorter than in E. Japonicus. R.H. 1849:221. B.M. 1649. G.C. III. 21:357. B.R. 11:884–5. The buds are particularly interesting. W. M.

ENTÀDA (a Malabar name). *Leguminòsæ*. A genus of 13 species of tropical, woody, spineless climbers, with bipinnate lvs. White fls., in spike-like racemes. One kind has lately been introduced from the West Indies to the southern states. It makes a quick growth. Petals free or slightly cohering, valvate: stamens 10, free, exserted: anthers crowned with a deciduous small gland: ovary many-ovuled. The lvs. often bear tendrils. Some of the species yield "Sea Beans" (G. F. 7:503).

polystàchya, DC. At length tendril-bearing: pinnæ in 4–6 pairs: lfts. in 6–8 pairs, oblong, rounded at apex: racemes in terminal panicles: pod oblong, straightish. Trop. Amer.

ENTELÈA (Greek, *complete;* the stamens all fertile, a distinguishing feature). *Tiliàceæ*. Perhaps 3 species of trees from New Zealand and Tahiti. The following is said to be an extremely fast grower in S. Calif., and is cult. abroad under glass, but, from the picture cited, it seems not worth the space in northern greenhouses. Lvs. 5-nerved, stellate-pubescent: fls. white, in terminal cymes; sepals 4–5; petals 4–5; stamens numerous, free: ovary 4–6-celled; cells many-ovuled: style simple.

arboréscens, R.Br. Attaining 30 ft.: the heart-shaped outline of the leaf broken on each side, about two-thirds of the way toward the tip, by a projection ⅓in. long or nearly as long as the tip of the leaf: lvs. 6 in. long, 4 in. wide, doubly serrate. New Zeal. B.M. 2480.—Int. by Franceschi.

ENTEROLÒBIUM (meaning not obvious). *Leguminòsæ*. Six species of tropical trees, of which 2 have been introduced into S. Calif. Unarmed: lvs. bipinnate: fls. greenish, in large heads or clusters; corolla 5-toothed; stamens any number up to 10, purple or white.

A. *Pod bent back in a complete circle.*

cyclocárpum, Griseb. Pinnæ in 4–9 pairs: lfts. in 20–30 pairs, unequal-sided, oblong, pointed. Cuba, Jamaica, Venezuela.

AA. *Pod forming half or two-thirds of a circle.*

Timboùva, Mart. "A truly magnificent tree, with shining bark and spreading head, sure to become popular in the South. Hardy at Naples, Italy."—*Franceschi*.

EOMÈCON (Greek, *eastern poppy*). *Papaveràceæ*. A rare, hardy herbaceous perennial plant with white fls., destined to no great popularity, but interesting to lovers of hardy borders. Hooker writes: "A beautiful monotypic genus, intermediate between Stylophorum and Sanguinaria, differing from both in the scapose habit, racemose fls. and sepals confluent in a membranous, boat-shaped spathe, and further from Stylophorum in the form of the lvs. and color of the fls., and from Sanguinaria in the four petals and elongate style." The plant is hardy with Woolson at Passaic, N. J.

chionántha, Hance. Rootstock creeping, ascending, full of yellow sap: lvs. all from the root; stalks twice as long as the blades; blades 3–6 in. long, heart-shaped, concave, broadly sinuate, rounded at the apex, bright pale green above, almost glaucous beneath: scape 1 ft. high, reddish: fls. 2 in. across, white; petals 4. Spring. China, not Japan. B.M. 6871. W. M.

EOPÈPON. See *Trichosanthes*.

ÉPACRIS (Greek-made name, *upon the summit;* referring to their habitat). *Epacridàceæ*. About 25–30 heath-like shrubs of Australia, New Zealand, etc., of which half a dozen or less are grown as cool greenhouse pot-plants. Lvs. small and entire, usually sharp-pointed, sessile or short-stalked, scattered or sub-opposite: fls. small and axillary, short-stalked, the flowering stems being elongated leafy spikes. The fls. are regular and perfect; calyx bracteate; corolla tubular, 5-toothed, white or shades of purple and red; stamens 5: ovary 5-loculed, ripening into either a fleshy or capsular fruit. Distinguished from Ericas by the bracteate or scaly calyx, and the anthers opening by slits rather than pores. In the Old World, Epacrises are prized by those who grow heaths, and many good varieties are known. They bloom in early spring or late winter. The varieties of *E. impressa* may be flowered for Christmas; perhaps others may be so treated. A carnation house, 50°–55°, suits them well. There are double-fld. forms. The most important to the horticulturist are:

impréssa, Labill. Three ft., erect, twiggy, downy: lvs. horizontal or deflexed, narrow-lanceolate and sharp: fls. rather large (often ½ in. long), tubular, pendent, on very short stalks, red or white. B.M. 3407. There are many forms: var. **parviflòra**, Lindl., B.R. 25:19; *E. campanulàta*, Lodd., with broader fls., L.B.C. 20:1925; *E. ceræflòra*, Grah., B.M. 3243; *E. nivàlis*, Lodd., snow white, L.B.C. 19:1821, B.R. 18:1531; *E. variábilis*, Lodd., blush, L.B.C. 19:1816; **longiflòra**, Cav. (*E. miniàta*, Lindl. *E. grandiflòra*, Willd.). Stems woolly, straggling: lvs. ovate-pointed or cordate-pointed, sessile or nearly so, many-nerved: fls. long (nearly 1 in.), red at base and white at the limb, cylindrical. B.M. 982. B.R. 31:5.—Handsome. Var. **spléndens**, Hort., has brighter colors.

acuminàta, Benth. Lvs. ovate, acuminate, clasping, ascending: fls. small, red, the corolla tube not much exceeding the calyx.

purpuráscens, R. Br. Lvs. ovate-acuminate, trough-shaped, tipped with a long curved point or spine: fls. short, the calyx nearly equaling the corolla, white or pinkish. There is a double-fld. form. L.B.C. 3:237. G.C. II. 5:340.—Probably identical with *E. pulchella,* Cav.

obtusifòlia, Smith. Lvs. small, elliptic or linear, thick and obtuse: fls. small, white, the spikes more or less one-sided. L.B.C. 3:292.

Other trade names are *E. ardentissima.* Fls. crimson.—*E. hyacinthiflòra,* var. *candidissima,* white, early, and var. *fùlgens,* pink.—*E. hybrida superba* is merely a catalogue name for mixed kinds of Epacris.—*E. rubélla.* Fls. bright red.—*E. salmònea.* L. H. B.

The genus Epacris (though perhaps not as well known as the Ericas, with which they are usually grown, requiring the same culture) furnishes the cool greenhouse with some of the most beautiful hard-wooded flowering plants known, the fls. embracing a good range of color. Where a good variety of these plants is grown, the flowering period extends from the end of January to the end of April. After flowering, the upright or bushy species should receive whatever pruning may be necessary to secure a well-shaped plant, while the pendulous varieties will require the shortening of only the strongest branches to induce a more even growth. If necessary, potting should be done at this time, and those which do not need repotting should have the drainage of their pots made perfect, as a water-logged condition of the soil is fatal to these plants. The soil best suited to them is two parts good fibrous peat, one part leaf-mold, and one part silver sand. In potting, small shifts should be given and the soil pressed as firmly as possible in the pots. After potting and pruning, the plants should be placed in a temperature of 60–65°, and syringed on all fine days to encourage fresh growth. During the summer they should be placed outside, in a position where they would receive some shade during the hottest part of the day, and the pots should be plunged in ashes or other non-conducting material. Careful watering is necessary at all times with these plants. If allowed to become dry, they will lose their lower lvs., which spoils their appearance; at the same time a saturated condition of the soil is fatal to them. Though they may be propagated by seeds, the use of cuttings of the young growth is more expeditious. These should be about 1 inch in length and the tip ends of the young growths. They may be inserted thickly in pans of sharp silver sand, with a glass bell-jar placed over them to keep them close. The pans should be plunged in the propagating bed and the cuttings carefully watered and shaded till rooted. The moisture which collects in the bell-jars should be wiped out two or three times a day, and a little ventilation from the bottom admitted after about the third day, removing the bell-jars altogether as the cuttings become rooted, which usually takes two or three weeks. When nicely rooted, they should be potted singly into thumb-pots and grown along, pinching when necessary to induce a bushy habit. EDWARD J. CANNING.

It is a good plan to plunge pots of Epacris in an open position and cover the plants during June and July with lath racks. About August, begin to remove the racks a few hours each day until the middle of September. Then remove the racks altogether. This practice hardens the wood and insures the setting of buds. A top dressing is a great help to Epacris and all hard-wooded plants. Hay or straw, run through a hay cutter, makes the best dressing. It can be put on quickly and evenly; it protects from the sun; it is light; it dries quickly, and has no bad effects, as manure does in the case of some hard-wooded plants. The writer has found the following sorts do well: Diadem, Eclipse, Her Majesty, Model, Rose Perfection, hyacinthiflora and vars. candidissima and fulgens, impressa alba, miniata vars. superba and splendens, rubra superba.

H. D. DARLINGTON.

EPHÈDRA (ancient Greek name, used by Pliny for the Horse-tail). *Gnetàceæ.* Generally low, much-branched shrubs, often procumbent and sometimes climbing, the green branches resembling much those of Equisetum, bearing minute, scale-like, sheathing lvs. in distant pairs or whorls: fls. inconspicuous, but fr. in some species decorative, berry-like and scarlet. They are but rarely grown, and most of them are tender; half hardy North are *E. distachya, foliata, Nevadensis, trifurca.* They can be used for covering dry, sandy banks or rocky slopes, and are prop. by seeds or by suckers and layers. About 30 species from S. Europe. N. Africa, Asia and in extra trop. Amer. Fls. diœcious, in small aments, forming usually peduncled axillary clusters; staminate fl. with a 2–4-lobed perianth and with the 2–8 stamens united into a column; pistillate fl. with an urceolate perianth, including a naked ovule, developing into a nutlet; in some species the bracts of the ament become fleshy, and form a berry-like syncarp. Latest monograph by O. Stapf, in Denkschr. Akad. Wissensch., Wien, Vol. 56 (1889), (in German and Latin).

E. distàchya, Linn. (E. vulgaris, Linn.). Low, often procumbent, 1–3 ft., pale or bluish green: lvs. one-twelfth in. long: aments usually clustered, staminate oblong: fls. with about 8 stamens, pistillate 2-fld.: fr. berry-like. S. Europe, W. Asia. Var. monostachya, Stapf. Aments usually solitary.—*E. foliàta,* Boiss. (E. Kokanica, Rgl.). Procumbent or erect, to 15 ft., bright or bluish green: lvs. ⅛–1-10 in. long: aments usually clustered, ovate; staminate-ovate fls. with 3–4 stamens; pistillate 2-fld.: fr. berry-like. W. Asia.—*E. Nebrodénsis,* Tineo. Erect, with rigid, pale green branches: lvs. ⅛ in. long: aments solitary or few; staminate globular; pistillate 2-fld.: fr. berry-like. Mediterr. region to Himal.—*E. Nevadénsis,* Wats. Erect. 2–3 ft., with pale or bluish green branches: lvs. ⅛ in.: aments usually solitary; staminate ovate 6–8-fld.; pistillate 2-fld.: fr. dry, with ovate bracts. Calif., New Mex.—*E. trifùrca,* Torr. Erect, with rigid, yellowish or pale green branches: lvs. in 3's, connate, about ¼ in. long: aments solitary; pistillate 1-fld.: fr. dry, the roundish bracts with transparent margins. Arizona to Colorado. ALFRED REHDER.

EPIDÉNDRUM (*upon trees,* alluding to their epiphytal habit). *Orchidàceæ,* tribe *Epidéndreæ.* Epiphytes: inflorescence simple or branched, nearly always terminal: claw of the labellum more or less adnate to footless column, the blade spreading and usually deeply lobed: pollinia 4, 2 in each anther cell, separated. Nearly 500 species discovered and described from central America.

Epidendrums are noted as the rankest weeds amongst the orchid tribes. The remarkable success in the raising of hybrids, be it in the genus itself, or with the related Cattleya and Lælia, has opened a wide field for the hybridist. Epidendrum seedlings grow freely; the time required to bring them to the flowering stage is little compared with other orchids, and it is but a question of a short time till the blood of the Epidendrums will be infused into the weaker but more gorgeous flowers of genera more difficult to grow. It is also the long stem and the grace of the racemes of the Epidendra, as well as the odor of some of their species, which the hybridist will try to blend with the largeness of short-stemmed flowers, of Cattleyas for instance. We therefore give below a list of the species but rarely found under cultivation, but the value of which will call for and justify large importations of their kind before long.

GEORGE HANSEN.

It is scarcely possible to apply any one rule for the cultivation of this widely divergent and large genus. which includes many hundreds of variable individuals geographically distributed all over tropical America. For convenience they are treated under their several separate sections.

Section I.—**Barkeria** embraces several deciduous, small-growing species which generally deteriorate sooner or later under cultivation. They succeed best in small baskets, suspended from the roof in rough, loose material, such as coarse peat fiber, with a small quantity of live chopped sphagnum moss added to retain moisture, this compost freely interspersed with pieces of charcoal or broken crocks or potsherds. They are all subjects for the coolhouse, require a free, moist atmosphere, shade from the sun while growing, and must be syringed frequently overhead in bright weather. After the plants have matured growth they should be removed to a rather sunny location and be syringed overhead often enough to keep them in sound condition until they start new action. While resting during winter the temperature may range from 50° to 55° Fahr. at night, and a few degrees higher during the day. They are increased by division. This should take place as the plants start growth action in early spring, allowing at least three pseudobulbs to each piece.

Section II.—**Encyclium,** of which *E. atropurpureum*, *E. nemorale* and *E. prismatocarpum* are good examples, may be grown either in pots or baskets in equal parts clean peat fiber and live chopped sphagnum, with a liberal amount of drainage, and excepting *E. vitellinum*, which must be grown cool, they require a moist, sunny location with a winter temperature of 58° to 65° Fahr. by night and several degrees advance during the day. In February and March, many species will start root or growth action; such as need it should then be repotted or top-dressed, as occasion requires. The temperature should be increased several degrees, and a greater amount of water be allowed with frequent overhead syringing on bright days. Ventilation should be given whenever the weather will permit, to keep the young growths from damping-off and the atmosphere active; at this time the plants will need light shading to prevent sun-burning. The stock is increased by cutting nearly through the rhizome 3 or 4 bulbs behind the lead, when starting action; this will generally cause the latent eyes to grow, but the pieces should not be removed until the new growth is well advanced.

Section III.—**Aulizeum** includes such species as *E. ciliare*, *E. cochleatum*, etc., the several requirements being identical with the preceding.

Section IV.—**Euepidendrum.** These are mostly tall growing reed-like species, of which *E. evectum* and *E. radicans* afford good illustrations. They are best adapted for pot culture. The pots should be two-thirds filled with drainage and the compost—consisting of about equal parts peat fiber and live sphagnum, well mixed—pressed in firmly about the roots, leaving the surface raised a little above the rim in the center when finished, to shed off surplus water. While the plants are growing they require a shaded, moist location, a day temperature of about 75° Fahr., with 5 or 10 degrees less at night. They should not be kept too wet at the roots, but overhead syringing in bright weather is very beneficial. While at rest, in winter the temperature should be modified 10 degrees and a more sunny location be given, with less frequent syringing, enough only to keep the canes or pseudobulbs in sound condition. Young plants often form in the axils of the upper leaves, and on the old flower stems it is best to let these young plants remain until they start their second growth, as they can be more safely removed at that time.

Section V.—**Psilanthemum** contains but one species, *E. Stamfordianum*, which requires the same general treatment as those in Section II.

Robert M. Grey.

INDEX.

atropurpureum, 15.
aurantiacum, 27.
bicornutum and bidentatum are Diacriums.
Brassavolæ. 16.
Capartianum, 20.
Catillus, 2.
ciliare, 23.
cinnabarinum, 3.
cochleatum, 24.
crassifolium, 5.
dichromum, 17.
elegans, 11.
evectum, 7.
eburneum, 4.
ellipticum, 5.
Endresii, 6.
falcatum, 25.
fragrans, 26.
Godseffianum, 20.
imperator, 2, 8.
leucochilum, 8.
Lindleyanum, 13.
maculatum, 21.
macrochilum, 16.
nemorale, 18.
odoratum is an Ærides.
osmanthum, 19.
paniculatum, 9.
Parkinsonianum, 25.
prismatocarpum, 20.
radicans, 10.
rhizophorum, 10.
roseum, 15.
sanguineum is a Broughtonia.
Skinneri, 12.
spectabile, 14.
Stamfordianum, 1.
tibicinus is a Schomburgkia.
venosum, 22.
violaceum is *Cattleya Loddigesii*.
vitellinum, 21.

A. *Inflorescence radical.* (*Psilanthemum.*)

1. **Stamfordiànum,** Batem. Stems fusiform, 12 in. long: lvs. 7–9 in.: large panicles of yellow and green fls., crimson spotted, fragrant. Mexico to New Granada. B.M. 4759. G.C. III. 17:655.

AA. *Inflorescence terminal.*

B. *Stems without bulbs: leaves distichous, alternate: only top of column free from lip.* (*Euepidendrum.*)

2. **Catíllus,** Reichb. f. (*E. imperàtor*, Hort.). Fls. cinnabar red. New Granada. I.H. 21:162.

3. **cinnabarinum,** Salzmann. Stems 3–4 ft.: fls. orange-red, 2 in. in diam., lobes of lip deeply fringed. Beautiful species. Braz. B.R. 28:25.

4. **ebúrneum,** Reichb. f. Stems terete, 2–3 ft.: fls. 3–4 in. in diam., yellowish green; lip ivory white, with yellow calli. Panama, in swamps. B.M. 5643.

5. **ellípticum,** Graham (*E. crassifòlium*, Hook.). Fls. on long scapes, clustered, rose or purple, ⅛ in. in diam. Braz. B.M. 3543.

6. **Éndresii,** Reichb. f. Stems 6–9 in.: racemes 9–12-flowered: fls. 1 in. in diam., pure white; lip and column spotted purple. Costa Rica. G.C. II. 23:504.

7. **evéctum,** Hook. Stems 3–5 ft.: peduncles nodding, 2 ft.: fls. rich purple, lip deeply fringed. New Granada. B.M. 5902.

8. **leucochilum,** Klotzsch (*E. imperàtor*, Hort.). Stems 2 ft.: fls. 5–9, on long pedicels, greenish yellow, lip pure white. New Granada, 6,000–9,000 ft.

9. **paniculàtum,** Ruiz & Pav. Stems 3–4 ft.: fls. ¾ in. across, lilac-purple, lip whitish yellow. Venezuela to Peru, high altitudes. Most free-flowering and best of paniculate species. B.M. 5731. I.H. 22:211.

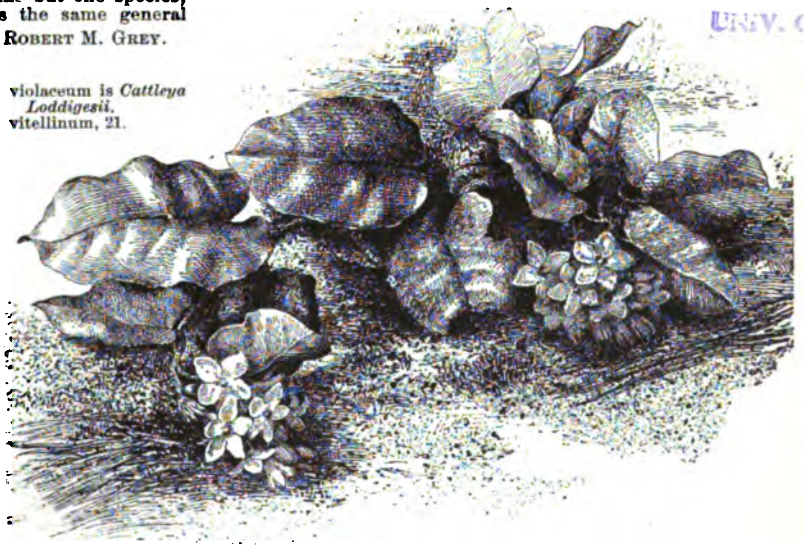
10. **radicans,** Pavon (*E. rhizóphorum*, Batem.). Stems semi-scandent, up to 5 ft. long, long white roots from opposite the leaves: fls. up to 2 in. in diam., numerous; most brilliant of the red-flowering species. Guatemala, amongst heavy grass. Gn. 24:412.

BB. *Stems thickened into pseudobulbs.*

C. *Pseudobulbs 2–4-leaved: labellum adnate less than half: column broad-winged.* (*Barkeria.*)

11. **élegans,** Reichb. f. (*Barkèria élegans*, Knowles & Westc.). Stems terete, 12 in.: pedicels 24 in.: fls. 5–7, nodding, 1½ in. in diam., lilac-purple; lip whitish, with purple blotch. Pacific coast of Mexico. B.M. 4784.

12. **Skinneri,** Bateman (*Barkèria Skinneri*, Paxt.). Lvs. ovate-oblong, sheathing the slender stem: peduncle terminal, bearing rose-lilac flowers about 1 in. across: petals and sepals nearly equal, petals so twisted at the base as to present dorsal surface to the observer: labellum ovate, with 3 raised lines. Guatemala. B.R. 22:1881. P.M. 15:1 (var. *major*).



763. Trailing Arbutus or Mayflower. (See Epigæa, page 535.)

13. **Lindleyànum**, Reichb. f. (*Barkèria Lindleyàna*, Batem.). Stems slender: fls. numerous, about 2 in. across, rose-purple; labellum with a white disk; petals broader than the sepals. Central America, 1839.

14. **spectábile**, Reichb. f. (*Barkèria spectábilis*, Batem.). FLOR DE ISABAL. Stems tufted, cylindrical, 4–5 in. high: lvs. 2: raceme about 6-fld.: fls. 3–4 in. across, bright lilac; sepals linear-lanceolate; petals ovate-lanceolate; labellum white at base, red-spotted. Guatemala.

cc. *Pseudobulbs 1–2-, rarely 3-leaved, labellum adnate at base, or not up to the middle, column not winged.* (*Encyclium.*)

15. **atropurpùreum**, Willd. (*E. macrochìlum*, Hook.). Pseudobulbs ovoid, 3–4 in. high: lvs. lanceolate, 12–15 in. long, dull purple colored: peduncle 6–10-fld.: fls. 2½ in. in diam., purplish brown upon greenish ground; lip yellowish white, with crimson stripes. Mex. to Venezuela. B.M. 3534. A.F. 6:609.

var. **ròseum**, Reichb. f. Sepals and petals purplish, lip bright rosy. Guatemala. P.M. 11: 243.

16. **Brassávolæ**, Reichb. f. Pseudobulbs pear-shaped: lvs. 6–9 in.: racemes 18–24 in., 6–9-fld.: fls. 4 in. across, sepals and petals narrow, yellowish brown; lip trowel-shaped, purple, white and green. Mex. to Guatemala, 8,000 ft. B.M. 5664.

17. **dichròmum**, Lindl. Fls. white, lip rose-colored, yellow and downy at base. Brazil.

18. **nemoràle**, Lindl. Pseudobulbs sub-globose, 3–4 in. high: lvs. 9–12 in.: peduncles 2 ft. long, covered with warts: fls. 3–4 in. in diam., rose-colored; lip rosy mauve, streaked with purple. Mex. B.M. 4606. G.C. II. 24:332. A.F. 6:633.

19. **osmánthum**, Rodrigues (*E. Godseffiànum*, Rolfe. *E. Capartiànum*, Lindl.). Fls. 1½ in. across, in large panicles, light green, suffused with brown; lip white, lined with rose-purple, fragrant. Braz.—One of the handsomest species.

20. **prismatocárpum**, Reichb. f. (*E. maculàtum*, Hort.). Pseudobulbs ovoid, tapering, 4–5 in.: lvs. 12–15 in.: fls. 1½ in. across, pale yellow-green, with purplish black spots; lip pale purple, with yellow tip and white border. Cent. Amer., 5,000 ft. B.M. 5336.

21. **vitellinum**, Lindl. Pseudobulbs ovoid, 2 in. long: lvs. 6–9 in.: peduncles 15–18 in., 10–15-flowered: fls. cinnabar-red; lip and column orange. Mex., 6,000–9,000 ft. B.M. 4107. G.C. III. 10:141.

Var. **màjus**, Veitch. Pseudobulbs shorter: racemes denser: fls. larger and more brilliant. G.C. III. 12:159.—Very superior to the species; type no longer imported.

ccc. *Pseudobulbs 1–2-, rarely 3-leaved: lip adnate up to apex of column.* (*Auliseum.*)

22. **venòsum**, Lindl. BUTTERFLY ORCHID. Scape 1 ft., with white sheaths: lvs. 3, 4–6 in. long, linear-lanceolate: scape tumid at base, 5–7-fld.: fls. pink, chocolate and green, about 1 in. long, lasting a long time. On oaks, etc., Mex.—Of easy culture. The Florida representative of this species is *E. Tampense*, Lindl. See 9th Rept. Mo. Bot. Gard. 137, plates 38, 39.

23. **ciliàre**, Linn. Pseudobulbs clavate, 4–6 in.: lvs. 4–6 in., springing from sheathing bract: peduncles 5–7-flowered: fls. yellowish green; lip white. Tropical America, between 5th and 20th parallel of north latitude. B.R. 10:784.—Plant resembles a Cattleya. Introduced to cult. in 1790.

24. **cochleàtum**, Linn. Pseudobulbs 3–4 in.: lvs. 6 in.: racemes 4–7-flowered: fls. 3–4 in. across, greenish white; lip deep purple beneath, light green above, with maroon blotch on each side, column white. Trop. Amer. from Fla. to New Granada. B.M. 572.—Introduced 1787, first epiphytical orchid to flower in England.

25. **falcàtum**, Lindl. (*E. Parkinsoniànum*, Hook.). Pseudobulbs thin, raising from running rhizomes, monophyllous: lvs. 6–12 in., fleshy, channeled on one side: peduncles 2–5, sheathed, 1-flowered: fls. 5 in. across, greenish yellow; lip white, greenish at apex. Mex. to Guatemala. B.M. 3778.—Plants grow inverted.

26. **fràgrans**, Swartz. Pseudobulbs fusiform, monophyllous, 3–4 in.: lvs. 8–12 in.: fls. inverted, 2 in. in diam., very fragrant, pale greenish or whitish; lip crimson streaked. Guatemala, through the West Indies to northern Brazil. B.M. 1669.

27. **aurantiacum**, Batem. Once classed in the separate group of Epicladium, now often accepted as a species of Cattleya, where it was first referred by Don. The plant grows with, and much resembles *Cattleya Skinneri*. Fls. 1½ in. across, orange-red. Guatemala.

Garden hybrids: *E. Bèrkeleyi* (Stamfordianum × O'Brienianum).—*E. Bùrtoni* (O'Brienianum × Ibaguense).—*E. Dellénse* (xanthinum × radicans).—*E. elegántulum* (Wallisii × Endresio-Wallisii). G.C. III. 19:361.—*E. Endresio-Wállisii*.—*E. O'Brieniànum* (evectum × radicans). G.C. III. 3:771.—*E. Phœbus* (O'Brienianum × vitellinum).—*E. radicánti-Stamfordiànum*.—*E. rádico-vitellìnum*.—*E. Wállisio-ciliàre*.—*E. xántho-radìcans*.

Euepidendrum: *E. arachnoglóssum*, André. Sts. 4–5 ft.: fls. rich purple-lilac; lip fringed, with orange calli. New Granada. R.H. 1882:554.—*E. cnemidóphorum*, Lindl. Sts. 4–6 ft.: racemes ample, drooping: fls. purple, brown and yellow, fragrant. Guatemala, 7,000 ft. B.M. 5656.—*E. conópseum*, R. Br. Scape few- to many-fld.: lvs. 1–3, thick: fls. green, tinged with purple, the sepals spatulate and revolute, the petals narrower and obtuse. S. Fla. and S. Once offered by Reasoner.—*E. Cooperiànum*, Batem. Sts. 2–3 ft.: fls. yellow-green; lip bright purple. Braz. B.M. 5654.—*E. Ellisii*, Rolfe. Fls. carmine-rose, very handsome. Columbia.—*E. fúlgens*, Brongn. Fls. orange-scarlet, in crowded racemes. Guiana to Braz.—*E. grácilis*, Lindl., was once offered by John Saul.—*E. Ibaguènse*, H.B.K. Sts. 2–3 ft.: fls. orange-scarlet; lip yellow. New Granada to Peru, 4,500 ft.—*E. myriánthum*, Lindl. Sts. 3-5 ft.: enormous panicles of rich purple fls.; lip with 2 yellow calli. Guatemala. B.M. 5556. Once offered by Saul.—*E. noctúrnum*, Linn. Sts. 2–3 ft.: peduncles 8–10-flowered: fls. white and yellowish, 5 in. across, very fragrant. S. Fla. and Mexico to Peru and West Indies. B.M. 3298. Once offered by Reasoner.—*E. palyígerum*, Reichb. f. Fls. beautiful lilac. Mexico.—*E. Pfávii*, Rolfe. Sts. 4–6 ft. high: fls. light purple; lip with white disk, in numerous racemes. Costa Rica.—*E. Pseudepidéndrum*, Reichb. f. Sts. 2–3 ft.: fls. 3 in. in diam., green; lip orange-red and yellow. Cent. Amer., 4,000 ft. B.M. 5929.—*E. raníferum*, Lindl. Sts. 2–3 ft.: fls. yellow-green, thickly spotted with purple. Mex. to Guiana. B.R. 28:42.—*E. rígidum*, Jacq., was once catalogued by Reasoner.—*E. Schómburgkii*, Lindl. Sts. 2–3 ft.: fls. vermilion. Guiana, Brazil, Quito. B.R. 24:53.—*E. syringothýrsis*, Reichb. f. Sts. 4–5 ft.: fls. deep purple; lip and column with orange and yellow, crowded in long racemes. Bolivia, 8,000–9,000 ft. B.M. 6145.—*E. Wállisii*, Reichb. f. Sts. 4–6 ft.: fls. yellow, some purple spots; lip orange and purple, upon white ground. New Granada, 4,000–7,000 ft. Has lateral as well as terminal racemes. Once offered by Saul.

Encyclium: *E. ádvena*, Reichb. f. Fls. yellow, veined brown; lip yellowish white, purple-streaked. Brazil.—*E. alàtum*, Batem. Fls. 2 in. across, purple and green; lip yellowish, streaked with purple, fragrant. Cent. Amer. B.M. 3898.—*E. bífidum*, Aublet. Fls. pale green, dotted with purple; lip rose, orange and white. W. Indies, Guiana. B.R. 22:1879.—*E. Friderici-Guiliélmi*, Warsc. & Reichb. f. Bulbs 4–5 ft.: fls. dark purple; base of lip white and yellow. Peru, 6,000–8,000 ft. I.H. 18:48. Once offered by Saul.—*E. gallopavìnum*, Reichb. f. Fls. brown; lip yellow, in large racemes. Brazil.—*E. oncidioìdes*, Lindl. Panicles up to 6 ft. long: fls. yellow and brown, sweet-scented. Stately species. Guiana. B.R. 19:1623. Once offered by Saul.—*E. phœniceum*, Lindl. Panicles 2–3 ft.: fls. deep purple, mottled green; lip rich violet, stained crimson. Handsome. Cuba.—*F. virgàtum*, Lindl. Scape up to 7 ft. high: fls. small, up to 20, greenish, stained brown. Mexico.

GEORGE HANSEN.

EPIGÆA (Greek, *epi*, upon, *gaia*, earth; in reference to its trailing growth). *Ericàceæ*. This genus includes our charming Trailing Arbutus, which in New England at least is the most popular of all our wild flowers. Creeping, branching, slightly woody, more or less rough hairy shrubs: lvs. alternate and entire, petiolate, leathery and evergreen: fls. monopetalous, perfect, large, dimorphous or diœcious, sessile in axillary or terminal clusters; sepals 5; corolla salver-shaped, with 5-parted spreading border; stamens 10, attached to the base of the corolla; style columnar; stigma 5-lobed: ovary ovoid, 5-celled, many-ovuled; capsule depressed-globose, encircled by the persistent calyx. Two species, N. E. America and Japan. The *E. cordifolia* quoted in Index Kewensis as South American is probably not of this genus. It seems to be known only from the old description of Swartz (1792).

The cultivation of the Trailing Arbutus, especially in localities where it has been exterminated by ruthless "Mayflower parties," always attracts interest. Only a brief epitome is here given. For fuller details, consult G.F. 5:202 and 8:15; also "The Nursery Book," which gives the experience of a specialist. Occurs in sandy and rocky woods, especially under evergreen trees in earliest spring. Thrives only in a humid soil and shady situations. Transplanted with difficulty. When a too great shock is received from difference of exposure, change of temperature, etc., it dies within 2 or 3 years, if established at all. Small plants must be procured, removed without harming the roots, and planted under the same conditions of soil and exposure with the greatest care. They may also be taken up in late September or October, new roots formed in the greenhouse or coldframe, wintered in a coldpit, but not planted until the second spring. Best on the north side of a hill, in light, sandy soil, mixed with leaf-mold. Once established it spreads rapidly. Prop. by division of old plants, layers or cuttings. Seeds are rarely found, but when found may be used, though slow to develop.

rèpens, Linn. TRAILING ARBUTUS. GROUND LAUREL. MAYFLOWER. (The Mayflower of English history and literature is the Hawthorn.) Fig. 763. Spreading on the ground in large patches, with hirsute branches 6–15 in. long just beneath the lvs., sending out roots and leaf- and flower-bearing stalks every 2–3 in.: lvs. oval or nearly orbicular, thick, acute or obtuse, cordate or rounded at the base, glabrous above, hirsute below, green on both sides, 1–3 in. long, petioles hairy: fls. spicy-fragrant, few or several crowded in clusters, practically diœcious, either stamens or pistils being abortive, the female fls. larger and whiter, the male smaller and rosy. Em. 431. G.W.F. 37. Mn. 3:17. Gn. 45, p. 193. Newfoundland to N. W. Terr., south to Fla., Ky. and Mich., chiefly east. The vernacular name is pronounced Ar′-bu-tus, not Ar-bu′-tus.

A. PHELPS WYMAN.

EPILÆLIA and **EPICATTLEYA** are bigeneric hybrids. See G.C. III. 16:629; 21:233; 22:83; 23:391.

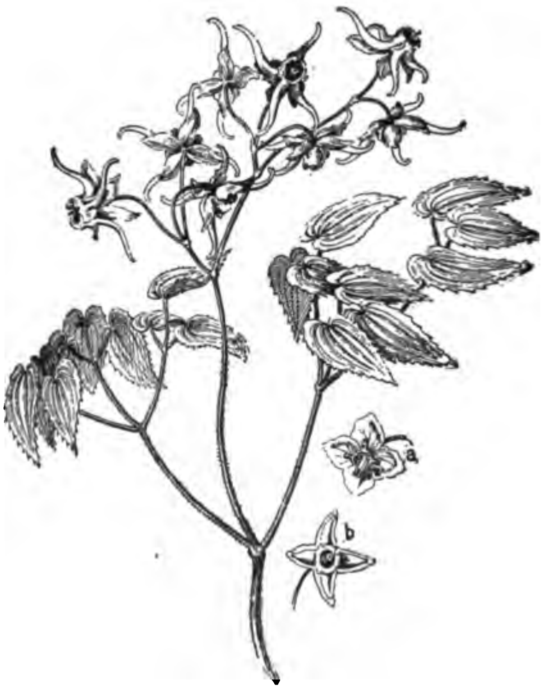
EPILÒBIUM (Greek, *upon the pod;* the flower and pod appearing together). *Onagràceæ.* This genus includes hardy herbaceous perennial plants, thriving in any soil, with willow-like foliage, and large, showy spikes of deep pink or rosy crimson fls. borne from June to August. They are particularly suited for naturalizing in meadows for mass effects. A genus of about 65 species, widely scattered in temperate and frigid regions: herbs, or subshrubs, erect, sprawling or creeping: lvs. alternate and opposite, toothed or not: fls. axillary or terminal, solitary or in spikes or racemes, rosy purple or flesh-colored, very rarely yellow; calyx tube scarcely, if at all, produced beyond the ovary; petals 4, obovate or obcordate, erect or spreading; stamens 8: ovary 4-celled; seeds comose.

The taller species, like *E. angustifolium* and *hirsutum*, make very rank growth in moist places, and are therefore especially adapted for the wild garden or for naturalizing along the water's edge and in low meadows. The underground runners travel great distances, and the plants spread fast when not kept in bounds. Prop. by division or seeds.

angustifòlium, Linn. (*E. spicàtum*, Lam.). GREAT WILLOW HERB. FIRE WEED. In cult. mostly branched and 3–5 ft. high; in the wild simple or branched, 2–8 ft. high: lvs. alternate, very short-petioled, lanceolate, entire or minutely toothed, 2–6 in. long, 4–12 lines wide, pale beneath, acute, narrowed at bases: fls. spreading, in long, terminal spike-like racemes, petals rounded at tip; stigma 4-lobed: capsules 2–3 in. long. Eu., Asia, N. Amer. B.B. 2:481. Var. **álba**, Hort., has pure white flowers suitable for cutting; also occurs wild. This variety was perfected in England. It forms a compact bush.

hirsùtum, Linn. Stout, 2–4 ft. high, with short but conspicuous soft hairs: lvs. oblong-lanceolate, usually opposite, sessile and often clasping, with many small, sharp teeth, 1–3 in. long, pubescent on both sides: fls. erect, axillary, about 1 in. across; petals notched. Ballast Weed from Europe. English names are Codlins and Cream, Fiddle Grass.

EPIMÈDIUM (Greek, *like Medion*, a plant said to grow in Media; a name from Dioscorides, retained by Linnæus). *Berberidàceæ.* This genus contains some of the daintiest and most interesting plants that can be grown in the hardy border, and *E. macranthum*, particularly, is as distinct, complicated and fascinating as many of the rare, tender and costly orchids. The whole tribe to which it belongs is exceptionally interesting, and is one of the most striking of those rare cases in which the cultural, botanical and artistic points of view have much in common. A well grown collection of these plants in pots would almost certainly win high praises and prizes. Of the 12 genera of this tribe, only Berberis and Nandina are shrubs, all the rest being herbs, with creeping, underground stems, and all small, choice, curious, and cultivated to a slight extent, except Bongardia and Leontice. Podophyllum contains our mandrake; Caulophyllum the quaint blue cohosh; and the others are Aceranthus, Achlys, Diphylleia, Jeffersonia and Vancouveria. A collection of all these plants should make a charming study. What appear to be petals in *E. macranthum* are really the inner row of sepals, colored like petals, and performing their functions, while the long spurs or nectaries are supposed to be highly specialized petals. Epimedium has 8 sepals and 4 petals, which are mostly small and in the form of nectaries: stamens 4: capsule opening by a valve on the back: lvs. pinnately twice or thrice dissected. They grow a foot or two high. For *E. diphyllum*, see *Aceranthus*, which is distinguished by its flat, not nectary-like petals, and its lvs. with a pair of leaflets on each of the 2 forks of the petiole. Of their culture J. B. Keller writes, "They thrive best in partial shade, and are particularly well suited for rockeries and the margins of shrubberies. Almost any soil will answer for them. The peculiar bronzy tints of the young foliage contrast well with the variously colored flowers. Prop. by division." These plants are suitable for pot-culture and for forcing. The Garden 48, p. 486, shows what a charming picture can be made of the foliage alone when cut and placed in a bowl. The plants retain their foliage all winter, especially in sheltered spots under trees.



764. Epimedium macranthum.

a, E. alpinum, var. rubrum; *b*, E. pinnatum, showing 8 types of spur or nectary.

A. *Spurs conspicuous, often 1 in. long, sometimes twice as long as the showy inner sepals.*

macránthum, Morr. & Decne. Fig. 764. Lvs. thrice ternate; leaflets cordate-ovate, unequal at the base, sharply toothed; petioles with short, spreading, conspicuous hairs: outer sepals sometimes colored bright red, remaining after the larger and showier parts of the fl. have fallen: inner sepals ovate-lanceolate, violet: spurs white. Japan. B.R. 22:1906. P.M. 5:151. Not Gn. 46:984, which is *E. pinnatum*. Var. **níveum**, Voss (*E. níveum*, Hort.), has pure white fls. Var. **ròseum**, Voss (*E. ròseum*, Hort. *E. níveum*, var. *ròseum*, Hort.), has fls. white, tinged with pink or pale rosy red. Var. **violàceum**, Voss (*E. violàceum*, Morr. & Decne.), has violet spurs, shorter than in *E. macranthum*, but much larger than in the other species. B.M. 3751. B.R. 26:43. P.M. 4:123.—A very interesting species.

AA. *Spurs medium-sized, nearly as long as the inner sepals.*

B. *Inner sepals bright red.*

alpinum, var. **rùbrum**, Hook. (*E. rùbrum*, Morren). Fig. 764. Lvs. biternate (but Hooker's picture shows a tendency to the thrice ternate condition), minutely toothed: spurs white, marked with red, as in Fig. 764, which shows the very distinct appearance of the flower. Japan. B.M. 5671. R.B. 3, p. 33, t. 6 (1853). Hooker says this differs in no way from *E. alpinum*, except in the larger and red fls., while the type which grows wild in England (though probably not native) has dull reddish yellow fls., and, though advertised, is probably not in cultivation.

BB. *Inner sepals whitish or pale yellow.*

Musschiànum, Morr. & Decne. Lvs. only once ternate, sharply toothed, as in *E. macranthum*: all floral parts whitish or pale yellow. Japan. B.M. 3745.—The least showy kind, but worth growing in a collection, its spurs having an individuality difficult to describe. Var. **rùbrum**, of Pitcher & Manda's catalogue, is presumably an error, as a red-fld. form would be very unexpected.

AAA. *Spurs much shorter than the inner sepals, being, in fact, merely small nectar-glands.*

B. *Lvs. once or twice ternate.*

pinnàtum, Fisch. Fig. 764. Lvs. usually biternate, with 5 leaflets, 3 above and 1 on each side; leaflets with a deeper and narrower basal cut than in *E. macranthum*: fls. typically bright yellow; nectaries red, a third or fourth as long as the inner sepals. Shady mountain woods of Persia and Caucasus. B.M. 4456. Gn. 46:984, erroneously as *E. macranthum*. Gn. 48, p. 486.

Var. **élegans**, Hort., presumably has larger, brighter and more numerous fls. *E. sulphureum* of European catalogues is regarded by J. W. Manning and J. B. Keller as a pale yellow-fld. form of *E. pinnatum*, but by Voss as a variety of *E. macranthum*. A yellow form of the violet-fld. *E. macranthum* would be very surprising.

Var. **Cólchicum**, Hort. (*E. Cólchicum*, Hort.), has brilliant golden yellow fls. and nectaries 1–1½ lines long.

BB. *Lvs. always once ternate.*

Perralderiànum, Cosson. This is the African representative of *E. pinnatum*, from which it differs in the key characters and also in the much more strongly ciliate-toothed leaflets. Its flowers are a "paler yellow than the typical *E. pinnatum*. It is far from improbable that specimens connecting them will be found in southern Europe, if not in Africa." Algeria. B.M. 6509.—Lvs. remain all winter. Less desirable than *E. pinnatum*.

E. diphýllum, Lodd. See Aceranthus diphyllus.—*E. niveum* is catalogued by Van Tubergen as a synonym of Musschianum, but the chances are that all the plants advertised as E. niveum are E. macranthum, var. niveum. The spurs are so obviously longer in E. macranthum that there is no excuse for confusion.

W. M.

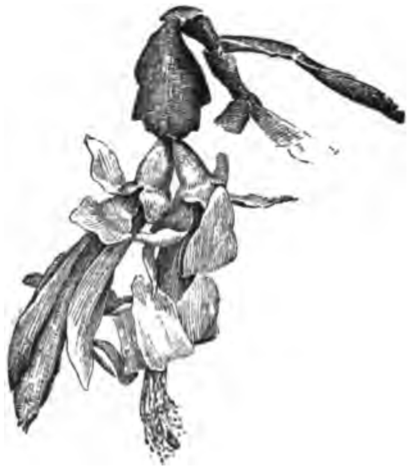
EPIPÁCTIS (Greek, *epipegnuo;* it coagulates milk). *Orchidàceæ.* Hardy terrestrial orchids of minor value. The first mentioned may be obtained through dealers in native western and Japanese plants; the second is listed in the American edition of a Dutch catalogue. Leafy orchids with creeping rootstocks and unbranched stems: lvs. ovate or lanceolate, with plaited veins: fls. purplish brown, nearly white or tinged red: lower bracts often longer than the fls.; sepals free, spreading, nearly as large as the petals; lip free, deeply concave at base, without callosities, narrowly constricted and somewhat jointed in the middle, the upper portion dilated, petaloid.

Royleàna, Lindl. (*E. gigantèa*, Dougl.). Stout, 1–4 ft. high: lvs. from ovate below to narrowly lanceolate above, 3–8 in. long: fls. 3–10, greenish, strongly veined with purple. June, July. Wash. to Santa Barbara, east to S. Utah and W. Tex., on banks of streams. Also Himalayas. Int. by Pringle and Horsford, 1883. Mn. 8:145.

atrórubens, Schult. [(*E. rubiginòsa*, Crantz). Lvs. often reddish: fls. and ovary dark purple; lip oval, acute, or slightly notched: bracts equaling the fls. or rarely longer. July–Sep. Eu., W. Asia.

EPIPHRONÌTIS is a bigeneric orchid hybrid of Epidendrum and Sophronitis, for a charming picture of which see R.H. 1896:476. It has about 10 fls., chiefly a brilliant scarlet, set off with bright yellow. Gt. 46, p. 555.

EPIPHÝLLUM (*on a leaf;* referring to the leaf-like branches on which the fls. grow). *Cactàceæ.* CRAB CACTUS. This genus is confined to Brazil, so far as known, where the plants grow as epiphytes upon the trees, along with orchids, growing in large clusters on the branches: stems flat and jointed, becoming rounded with age, bearing areolæ only on the margins and more or less truncated ends, from which grow the new branches and fls.: fls. more or less conspicuously zygomorphous: ovary devoid of bracts, and those of the tube comparatively large and colored as the petals. The genus is closely allied to Phyllocactus, and, indeed, the last two species are referred by some authors to that genus. In cultivation many forms have been produced through hybridization between the different species and with Phyllocactus and Cereus, so that typical plants are rarely met with. C. H. THOMPSON.



765. Epiphyllum truncatum.

Epiphyllums are among the most useful as decorative plants of all the Cactaceæ. Their brilliant colored blossoms, together with the profusion with which they are usually borne, makes them worthy of a place in every collection of plants. They are propagated by cuttings, which root readily when inserted in an ordinary propagating bed. Being low-growing or pendent-habited plants, they are very useful subjects for hanging baskets. Like most of the Cactus family, they may be grafted readily upon other Cacti. When grown as pot-plants, they are often grafted to elevate them above the pots, so as to show them off to better advantage when in flower. *Pereskia aculeata* and *P. Bleo* are the stock most commonly used for grafting Epiphyllums upon, though some gardeners prefer grafting upon *Cereus triangularis*, taking clean, healthy pieces about 1 foot in length, first rooting them and establishing them in pots, then grafting when active growth of the Epiphyllums commences in spring. It is said by some gardeners that Epiphyllums do better and may be brought into flower earlier by grafting on *Cereus triangularis*. Other species of Cereus may also be used as stock plants for grafting upon, especially the upright-growing species, as *C. colubrinus*. The system known as wedge-grafting is the best method.

When grown upon their own roots, the soil best suited to them is two-thirds fibrous loam and one-third leaf-mold, with a fair proportion of silver sand and pounded brick added to keep the soil porous, as they are very impatient of too much moisture at the roots. The pots or pans in which they are grown must also be well drained. They require careful watering at all times, but during the fall and early winter they should receive only enough to keep them from shriveling. They are best kept in the greenhouse the whole year round, giving them an abundance of air during the summer to insure well ripened growth. A temperature of 45–50° during winter will be sufficient, though a higher temperature may be given after January 1 if wanted in flower earlier.

EDWARD J. CANNING.

truncàtum, Haw. CRAB CACTUS. CHRISTMAS CACTUS. Fig. 765. Stems much branched and hanging in large bunches from the trees: joints obovate to oblong, with strongly truncate apex, 1½–2 in. long by about ¾–1 in. broad, bright green, margins coarsely serrate, with 1–3 large, acute teeth on each side, the 2 upper ones forming more or less incurved horns on either side of the truncation: areolæ bearing a few short, yellowish or dark colored bristles, or sometimes none: fls. horizontal, growing from the truncated end of the younger joints, strongly irregular, 2½–3½ in. long, in various shades of red: fr. pear-shaped, red, about ⅝in. in diam. Braz. B.M. 2562. G.C. III. 19:9. —Most of the forms in cultivation are hybrids between this species and some other of the genus or with Cereus. Fig. 766. A common basket and rafter plant.

766. Epiphyllum truncatum × Russellianum.

Russelliànum, Hook. Stems more upright, with pendent branches: joints ¾–1½ in. long by ⅜–¾ in. broad, oblong or elliptical to obovate, light green; margins crenate, with 2–4 areolæ on either side, bearing a few very short dark gray bristles: fls. from the end of the youngest joints, red, 1¾–2¼ in. long: fr. red, 4-angled or narrow-winged. Bras. B.M. 3717.

Gàertneri, K. Sch. (*E. Russelliànum*, var. *Gærtneri*, Reg.). EASTER CACTUS. Stems of more upright habit, with drooping branches: joints long-oblong or elliptical to obovate, ⅝–2¼ in. long by ½–1 in. broad, dark green, margins crenate, with about 5 areolæ on either side, bearing 6–12 rather stiff, long, yellow or brown bristles, and are especially conspicuous on the truncated apex, where they form a considerable beard: fls. from the apex of the youngest joints, 2½–3 in. long, scarlet-red: fr. red. Braz. B.M. 7201.

Epiphyllum Guedeneyi, Houllet—Phyllocactus sp.

C. H. THOMPSON.

EPIPHYTES, or air plants, grow on trees or other plants without robbing them of food. Orchids are the most famous examples among garden plants. Some orchids, however, grow in the soil, and others are true parasites. Plants that live on decaying organic matter, and have lost more or less of their leaf-green, are called saprophytes. Many mosses are Epiphytes.

EPÍSCEA (Greek, *shady*; they grow wild in shady places). *Gesneràceæ*. Probably the best garden form of this genus is the refined and elegant basket plant, *E. cupreata*, with its rich, coppery colored, softly hairy leaves, shown in Fig. 767. The genus has perhaps 30 species, all tropical American. Herbs with long, short or no hairs: stem from a creeping root, branched or not: lvs. opposite, equal or not in size: fls. pedicelled, axillary, solitary or clustered; corollas mostly scarlet, rarely whitish or purplish; tube straight or curved, more or less spurred at the base; limb oblique or nearly equal; lobes 5, spreading, rounded.

767. Episcea cupreata.

Episcea cupreata is one of the standard basket plants, especially for the warmest greenhouses. It can also be used in pyramids and mounds, as told under Fittonia. As it does not require so close an atmosphere as the Fittonias, it can be grown in some living rooms and perhaps outdoors in summer in a shady place. Its chief charms are the slender, trailing habit, the soft hairiness of the leaves, the coppery hue, which is often laid on like paint in two broad bands skirting the midrib, and the rarer and perhaps finer metallic bluish luster of which one occasionally gets a glimpse in a finely grown specimen. Give very rich, fibrous loam, and in summer partial shade.

A. *Fls. white.*

Chontalénsis, Hook. (*Cyrtodeìra Chontalénsis*, Seem.). Stems stout, more or less ascending, dark reddish purple, 6–10 in. long: lvs. opposite and irregularly whorled, 3–4 in. long, oblong-ovate, crenate, obtuse, rounded at the base, decidedly convex on both sides of the midrib and between the much-sunk veins, margins recurved, green, marked with regular purple patches, which advance from the margins between the veins toward the midrib and are more or less oblong: fls. in 1's and 2's; corolla tube with a sac at the base, the limb oblique, 1½–2 in. across, with small and regular but conspicuous and beautiful teeth. Chontales region of Nicaragua. B.M. 5925. R.B. 22:241. F.S. 18:1924.

AA. *Fls. scarlet.*

cupreàta, Hanst. (*Achimènes cupreàta*, Hook.). Fig. 767. Stems slender, creeping, branched, rooting at the joints, with a main branch rising erect a few inches, which bears the fls. and the largest lvs.: lvs. copper-colored above: fls. solitary, 9 lines wide, scarlet, with a small sac and denticulate limb. Nicaragua. B.M. 4312. Var. **viridifòlia**, Hook., has green foliage and larger fls., 1 in. across. B.M. 5195.

coccínea, Benth. & Hook. (*Cyrtodeìra coccínea*, Hort., B. S. Williams). Lvs. dark metallic green, 3–4 in. long, 2½–3 in. wide. Free-flowering.

ROBERT SHORE and W. M.

EQUISÈTUM contains the weed known as Horse-tails, or Scouring-rushes. They are suitable for naturalizing in waste and wettish places. They hold sandy banks. The following have been advertised by dealers in native plants: *E. arvénse, hiemàle* (Fig. 768), *limòsum, praténse, robústum, scirpoìdes, sylvàticum, variegàtum.* For descriptions, consult the manuals. They grow usually in moist or swale-like places. They are flowerless plants, allied to ferns and club-mosses.

768. Equisetum hyemale—Common Scouring-rush.

ERAGRÓSTIS (Greek, *love* and *grass*). *Gramíneæ.* Love Grass. Annual or perennial grasses, with herbaceous stems of various habits, and from 6 in. to several feet tall. Culms simple or often branched. Inflorescence composed of very variable panicles, either close and narrow, or loose and widely spreading: spikelets 2–many-fld., the uppermost imperfect. Closely allied to Poa, from which it can be distinguished by its 3-nerved fl.-glumes, which are destitute of any woolliness. The species are very variable and their limits hard to define. About 100 species occur in the warm and temperate regions of both hemispheres, few of which are of any agricultural or horticultural value. The following are cult. as "ornamental grasses" in flower gardens.

Abyssínica, Link. A branching, leafy annual, 2–4 ft. high, with widely spreading capillary panicles of many spikelets: lvs. 12–14 in. long, rough on the upper side, ligule a mere ring: panicles slender, gracefully drooping, grayish when in full bloom: spikelets 5–7-fld., one-fifth of an inch long. Africa.—In cult. as an ornamental grass for bouquets. Grain used as food in Africa. By some referred to Poa.

amábilis, Wight & Arn. (*Pòa amábilis*, Linn.). An erect grass 6 in. to 1 ft. high, with inconspicuous linear-lanceolate lvs., ciliate at the base: spikelets very large and broad, closely resembling quaking-grass (Briza), 16–24-fld. India.—In cult. as an ornamental grass.

élegans, Nees. Feather Love-Grass. An erect grass 1–2 ft. high, with smooth culms and rough lvs.: panicles closely contracted, dense: spikelets very small, 4–7-fld., numerous, and presenting a feather-like appearance in mass. S. Amer.—In cult. as an ornamental grass.

máxima, Baker. Large Love-Grass. A tall, robust plant, 2–3 ft. high, with lanceolate acuminate lvs., cordate at the base: panicles very lax and broad, 6–9 in. long: spikelets oblong, flattened, very large, ½–⅝ in. long. Madagascar.—One of the most ornamental species of the genus.

collina, Trin. (*E. suavèolens*, Becker). Fig. 769. An erect, leafy annual, 1–3 ft. high, with densely fld., spreading panicles: spikelets 6–13-fld., numerous, one-fifth in. long: pedicels of spikelets and branches of panicle rough: lvs. smooth beneath, rough above. Asia.—The species is very variable under cult., many different forms being found. In cult. as an ornamental grass for bouquets.

E. màjor, Host. Stink Grass. A common species, growing chiefly in cultivated or waste ground. When fresh it emits a strong, unpleasant odor.—Intr. from Eu.—*E. pectinàcea*, Nees. Meadow Comb-Grass. A very pretty perennial grass, with showy colored spikelets. A native of the eastern, southern and middle states. It is often gathered for dry bouquets. Should be int. into cult. for ornament.

The seed sent out by a leading seedsman as containing five different species (*E. elegans, amabilis, maxima, suaveolens*, and *Poa amabilis*), when grown proved to be one and the same thing: viz., *E. suaveolens*. This statement is made from specimens grown by Professor Tracy, of Starkville, Miss., in 1885, and also observed by myself in 1897, both in the Hort. and the Bot. Gardens at Cornell University.

P. B. Kennedy.

ERÁNTHEMUM (Greek, *lovely flower*). *Acanthàceæ.* Perhaps 30 species of tropical shrubs and subshrubs, some of which are cultivated chiefly for their foliage and others for their flowers. Lvs. entire or rarely coarsely toothed: fls. white, lilac, rosy or red, borne in various ways; bracts and bractlets narrow, small; corolla tube long, slender, cylindrical throughout or rarely with a short throat; limb 5-parted; stamens 2: ovules 2 in each cell; seeds 4 or fewer. The genus Dædalacanthus, although in a different tribe, is separated only by a combination of technical characters, but the garden forms of both genera described in this work are all distinguishable at a glance. For culture, see *Justicia*. Consult *Dædalacanthus*.

A. *Fls. purple.*

laxiflòrum, Gray. Height 2–4 ft.: lvs. on the same plant varying greatly in size and shape, those near the fls. 2–3⅛in. long, 8–15 lines wide; petioles 2–6 lines long, widest below at or above the middle, more or less ovate-oblong, obtuse, narrowed at the base: fls. in cymes; stamens 2, perfect, sharp-pointed. Fiji. B.M. 6336.

AA. *Fls. pure white.*

tuberculàtum, Hook. Easily told while growing by the many small roundish and rough elevations on the branches: lvs. small, ⅜–⅝ in. wide, rarely if ever 1 in. long, broadly ellipitical, obtuse or notched, almost sessile: fls. numerous, borne singly in the axils, in summer; corolla tube very long and slender, 1¼ in. long; limb 1 in. across; stamens scarcely exerted. Habitat unknown. B.M. 5405.

AAA. *Fls. white, speckled with red-purple.*

B. *Foliage netted with yellow.*

reticulàtum, Hort. (*E. Schómburgkii*, Linden). Height 4 ft.: upper lvs. 2–7 in. long, ovate-lanceolate, characteristically netted with yellow; lower lvs. 6–10 in. long, not netted, but the veins prominent and yellow: fls. racemose; corolla speckled with blood-red at the mouth; anthers reddish brown, exserted. Possibly Australia. B.M. 7480. I.H. 26:349.

769. Eragrostis collina (× ¼).

BB. *Foliage not netted with yellow.*

Andersoni, Mast. Lvs. lanceolate or elliptic, narrowed into a short stalk: fls. in a spike 6 in. long; lower middle lobe of the corolla larger and speckled with purple. Trinidad. Gn. 45:943.

The following trade names belong to plants grown chiefly for their foliage. Probably many of them belong in other genera. —*E. albo-marginàtum*. Lvs. broadly margined with white and irregularly suffused gray.—*E. atrosanguineum*, Hort. Int. by W. Bull, 1875. Lvs. large, dark wine-purple, or blackish crimson, ovate entire, opposite, stalked. Said to endure the hottest sunshine.—*E. cultràtum*. "Lvs. shining, thick, deep-veined."—*E. Eldoràdo*. Lvs. greenish yellow, veins deeper yellow.—*E. nerium rùbrum* of Pitcher & Manda's catalogue, presumably a misprint for *nervum-rubrum*, has lvs. "irregularly shaped, shaded with light and dark green, and blotched with yellow, which darkens to reddish purple." Possibly = Fittonia Verschaffeltii.—*E. nigrèscens*. Presumably with blackish lvs.—*E. purpùreum*. "Lvs. and stems dark, lurid purple." Siebrecht & Wadley.

The following trade names are accounted for in other genera: *E. igneum*. See Chamæranthemum. — *E. nervosum* and *pulchellum*. See Dædalacanthus. W. M.

ERÁNTHIS (Greek, *er*, spring, and *anthos*, a flower; from the early opening of the flowers). *Ranunculàceæ*. WINTER ACONITE. Low perennial herbs, with tuberous rootstock: basal lvs. palmately dissected, one stem-leaf sessile or amplexicaul just beneath the large yellow fl.: sepals 5–8, petal-like; petals small, 2-lipped nectaries; stamens numerous; carpels few, stalked, many-ovuled, becoming follicles. About 7 species, natives of Europe and Asia. Very hardy, and at home in half-shady places, among shrubs or in the border; very desirable because of the very early, bright fls. Prop. by division of roots. The place where the tubers are planted should be marked during the summer, when the foliage is dead.

The earliest generic name is *Cammarum*, which was given in Hill's British Herbal, p. 47, pl. 7 (1756), or 51 years before Salisbury made the name *Eranthis*.

770. Eranthis hyemalis.

hyemàlis, Salisb. (*Hellèborus hyemàlis*, Linn.). Fig. 770. Erect, 5–8 in.: basal lvs. long-petioled: involucre 12–15-parted, the bright yellow-fls. always sessile; anthers oblong. Jan.–March. Naturalized from Eu. B.M. 3. Mn. 8:43. G.C. II. 11:245.

Var. **Cilícica**, Huth. (*E. Cilicica*, Schott & Kotschy). Much like the above. Involucre of deeper and more numerous lobes: anthers ovate instead of oblong; sepals broader, being about ½ in. across; follicles always straight. Season a few weeks later.—The stems, when grown in gardens, said to be red-brown. Roots of this were first sent to England from its native home near Smyrna in 1892. Rare in Amer. G.C. III. 13:266. Gn. 45, p. 192 (note).

Sibírica, DC. Much dwarfer, seldom over 3–4 in. high: fls. bright yellow, a little smaller than those of *E. hyemalis*, 5-sepaled. Siberia.

J. B. KELLER and K. C. DAVIS.

EREMÙRUS (Greek name, probably referring to their tall and striking aspect in solitary and desert places). *Liliàceæ*. These hardy desert plants when in flower, with their great flower-stalks taller than a man, and crowned with a spike of fls. from 1–4 ft. long, are amongst the most striking spectacles in the choicer gardens of the North and East. Their roots are clusters of fleshy fibers: their lvs. all from the root, in dense rosettes, long and linear: fls. white, yellow or rosy; perianth bell-shaped or more widely spreading, withering and persisting or finally dropping away; segments distinct or very slightly united at the base; stamens 6: ovary 3-celled; seeds 1–4 in each cell, 3-angled.

W. M.

E. robustus and *E. Himalaicus* are probably the hardiest of all the tall, desert-inhabiting plants of the Lily family—a family including the Poker Plant, the Aloes, the Yuccas, and many others that are not so tall and striking in appearance or else too tender to grow outdoors in the North. Large specimens of *E. robustus* will annually produce a flower-stalk 8 ft. or more high, with racemes 4 ft. long, remaining in bloom for a month. After flowering the lvs. disappear entirely, but early in spring they reappear, and should then be covered with a box or barrel, to protect the forming flower-stalk from late frosts. A mound of ashes over the crown in winter is advisable, or a box with water-tight top filled with dry leaves. Both species like a rich soil, moist but well drained, and plenty of water in the flowering period, but none afterwards. Prop. by division, or slowly by seeds. Large plants are expensive, but they can sometimes be obtained large enough to flower within a year or so of purchase. It tries one's patience to wait for seedlings to reach flowering size. The flowers look like small stars. W. C. EGAN.

A. *Flowers rosy.*

B. *Lvs. linear-ligulate.*

robústus, Regel. Root-fibers thick and fleshy: lvs. glaucous, glabrous, linear-ligulate, 2 ft. long, 1½–2 in. wide, roughish on the margin, with minute recurved teeth: raceme 4–4½ in. wide: stamens about as long as the perianth. Turkestan. B.M. 6726. Gng. 6:52, 324. Gn. 46, p. 335. Mn. 8:123. J.H. III. 29:267.

BB. *Lvs. ovate-lanceolate.*

Élwesii, Micheli (*E. Elwesiànus*, Hort.). Lvs. light green, ovate-lanceolate, obtuse, flat, not at all rough at the margin, shorter than in *E. robustus*, nearly triangular, even more glaucous, and beginning to decay at the time of flowering: perianth segments with a band of deeper color down the middle. Habitat ? R.H. 1897:280. Gn. 54, p. 99. G.C. III. 24:137.—Int. by Leichtlin as *D. robustus*, var. *Elwesii*.

AA. *Flowers white.*

Himalàicus, Baker. Root-fibers thick and fleshy: lvs. 9–12, ligulate, firm, persistent, 1–1½ ft. long, 6–15 lines wide above the middle: raceme 3–3½ in. wide: stamens about as long as the perianth. Himal. B.M. 7076. Gn. 49, p. 131. G.C. II. 16:49.

AAA. *Fls. some shade of yellow.*

B. *Color light yellow.*

spectábilis, Bieb. Root-fibers thick and fleshy: lvs. 6–15, lorate, slightly glaucous, 12–18 in. long, 6–12 lines wide above the middle, noticeably narrowed at the base: raceme 1–1½ ft. long, 2 in. wide: stamens orange, finally twice as long as the perianth. Asia Minor, Persia. B.M. 4870.

BB. *Color pure yellow or orange.*

Búngei, Baker. Lvs. contemporary with the fls., linear, 1 ft. long, less than 3 lines wide: raceme 4–5 in. long, 2 in. wide: stamens finally twice as long as the perianth. Persia.—Var. **perféctus**, Hort., is sold.

BBB. *Color orange.*

aurantiacus, Baker. Closely allied to *E. Bungei*, but live plants have less acutely keeled lvs.: root-fibers tapering upwards, and orange fls. and stamens. Bokhara, Turkestan. B.M. 7113. W. M.

ERIÁNTHUS (Greek, *woolly flower*). *Gramineæ*. WOOLLY BEARD GRASS. PLUME GRASS. Tall and stout reed-like perennials, with the spikes crowded in a panicle and clothed with long, silky hairs, especially in a tuft around the base of each spikelet. Spikelets in pairs, one sessile, the other pedicellate. Glumes 4, the fourth enclosing a hermaphrodite flower and awned. Species about 18, in the warmer regions of both hemispheres.

Erianthus Ravennæ is the best hardy substitute for the pampas grass, which is the most famous of all tall, plumy grasses. For general purposes and for aquatic groups and bedding it has no peers in the North except *Arundo Donax* and a few tall bamboos. These latter, however, are grown for their foliage effects, and while the plumes of Arundo are highly ornamental, they are only an incident in the North, where frost often cuts down the plants before they flower. The general appearance of Erianthus is striking and unique, and for the plume-like character of its flowers it has few if any rivals.

Ravénnæ, Beauv. (*Sáccharum Ravénnæ*, Muir.). Wool Grass. Plume Grass. Ravenna Grass. A tall, hardy grass, 4–7 ft. high, very ornamental, either planted alone or in company with other grasses: lvs. very long, linear, pointed, band-like, sometimes violet, with a strong white rib in the center. The foliage forms graceful clumps, from which rise long and handsome plumes, resembling the pampas grass (*Gynerium argenteum*). Southern Europe. R.H. 1890, p. 546. Gn. 54, p. 496.—Its cultivation is not difficult in ordinary garden soil. A sunny situation is preferable. May be propagated by division or by seed. It is exquisite for lawns, and flowers the first season if sown very early. The plumes are fine for winter use when dried.

P. B. Kennedy and W. M.

ERÌCA (practically meaningless; probably not from *ereiko*, to break, as commonly stated). *Ericàceæ.* Heath. This is the genus that the gardener usually means by "Heath." The Heath or heather of English literature and history belongs to the closely allied genus Calluna. The next most important group of cultivated "Heaths" is Epacris, which, however, belongs to a different order. Ericas are low-growing, evergreen, much branched shrubs, with needle-like lvs. in whorls of 3–6, and great numbers of small rosy, white, or rarely yellow fls., of which the most important types are the bell-shaped, the tubular, and the ventricose, the last being swelled at the base, and then tapering to a narrow neck just below the 4 spreading lobes. Erica is an enormous genus, and the hybrids are past reckoning.

Only a few of the European Heaths are hardy in America, and we have no native Heaths at all in this hemisphere. Of about 14 kinds of Erica grown outdoors in Europe to produce large showy masses, only 3 are hardy here, and it is safest to cover these with evergreen boughs in winter. Two others (*E. Mediterranea* and *E. Lusitanica*) we grow under glass somewhat. The tree Heath of southern Europe (*E. arborea*) will probably never be a feature of our southern landscapes.

The halcyon days of the Heaths were from about 1806 (when the English took the Cape of Good Hope) until the middle of the century. Andrews' colored engravings of Heaths (1809) marks the first flush of their popularity. Practically, if not absolutely, all the Heaths that are grown on a large scale have been developed from the South African species. The old English gardeners still lament the glorious days when the hard-wooded plants of Australia and the Cape formed the chief feature of European indoor horticulture. They complain that the present generation is not willing to give them the care they deserve. This is especially true of America. Nevertheless, according to William Watson, of Kew (in Garden and Forest, 1892, p. 136), Heaths are still grown in surprising quantities. Speaking of *E. hyemalis*, he says: "It may be said with truth that no other plant is grown in such enormous quantities for the London market. At least a dozen nurserymen might be named whose annual output of this one Heath amounts to from 20,000 to 30,000 plants each." He pictures a plant in a 5-inch pot, with about 15 shoots a foot high, and loaded with perhaps 1,000 flowers. Such plants sell at Christmas for about 36 cents. "The flowers remain fresh for at least a month. The popularity of this Heath is thus easily accounted for: it is cheap, very pretty when in flower, and lasts just long enough to satisfy the masses who like window-plants and change. The plants perish almost as soon as the flowers—that is, all those which find their way into the window of a house, or into a small greenhouse. And this accounts for the enormous number disposed of every year. In England *E. hyemalis* is certainly one of the most valuable plants ever introduced." (In America Heaths are of minor importance, even at Easter, and the kind grown most extensively for Christmas seems to be *E. melanthera.*) Watson adds: "It is strange that a plant which has enjoyed an exceptional popularity in England for something like fifty years should never have been figured in any English publication or work until now. I have not been able to trace the origin of the plant, nor find any picture of it in any book to which I have access here. Nor can any of those who have paid attention to garden Heaths assist me."

The great trouble with Heaths is the immense amount of care they need. Few, if any, classes of plants require more attention. Hence the growing of Heaths for the market is extremely specialized, and there is not a retail catalogue in the country that offers more than one species. Nevertheless, all the kinds described below are grown commercially, and are of the first importance in the genus. The stock is largely imported from England. Germany has a very different set of varieties, and France still another, and there are few cases among cultivated plants showing so great a difference in the three countries. The risks of importation are considerable, and the tendencies toward American independence in this line seem to be gaining.

Another difficulty in Heath culture is the poor quality of peat obtainable in America. In England the peat is more fibrous, and has been formed in past ages largely by the decay of the native heather.

771. Erica hyemalis.

From 300,000 to 400,000 plants of this Heath are sold in London every Christmas.

The soft-wooded kinds are the ones most grown. The hard-wooded sorts require a longer period of growth and more thorough ripening of the wood.

Apparently only one yellow-fld. Heath is cult. in America, *E. Cavendishedna.* Unless otherwise stated, the species described below come from the Cape.

In general the Ericas do not grow well in this climate on account of the extreme heat of the summer months, but some varieties grow and flower even better here than in Europe. The choice of the soil is very important. A light peat, mixed with sharp, coarse sand is about the best we can get here. After flowering, the plants should always be cut down to keep them bushy at the base and well shaped. They will then receive a good repotting, using always very clean pots and plenty of drainage. Cuttings are made from December to April, preferably from young plants, the tender shoots, about 1 inch in length, being best. These are planted firmly in a pan filled with clean, fine sand, and covered with a bell-glass, or in a box covered tightly with a pane of glass. Bottom heat is not necessary. When rooted, the cuttings should be potted in small pots, and when well started should be given as much air as possible. It is well to bring the Ericas out of the greenhouse as early in the spring as possible. The pots should be plunged in a good situation, where plenty of air and sunlight can be had. They should be wintered in a greenhouse extremely well ventilated, and a temperature not higher than from 40° to 45° F. When in bud the plants should not be allowed to dry out too much. Once would be enough to cause the loss of all the buds. Very often the Heaths are attacked by a disease similar to mildew, caused by an excess of humidity in the air. As this disease is very contagious, it is well, as soon as noticed, to use sulphur in powder or sulphate of copper in solution until the plants are rid of it.

Index of species described below:

assurgens, 13.
Bothwelliana, 17.
Caffra, 13.
carnea, 1.
Cavendishiana, 11.
Cavendishii, 11.
codonodes, 14.
cupressina, 15.
cylindrica, 12.
fragrans, 9.
gracilis, 7.
herbacea, 1.
hiemalis, 5.
hyemalis, 5.
Lusitanica, 14.
Mediterranea, 16.
melanthera, 8.
Parmentierii, 6.
persoluta, 13.
præstans, 6.
regerminans, 3.
Tetralix, 4.
translucens, 18.
vagans, 2.
ventricosa, 17.
Vilmoreana, *Wilmoreana* and Wilmorei, 10.

A. *Hardy Heaths.*
B. *Spring-blooming* .... 1. **carnea**
BB. *Summer- and fall-blooming.*
C. *Inflorescence lateral* .... 2. **vagans**
CC. *Inflorescence terminal.*
D. *Ovary densely covered with long, rough hairs* .... 3. **stricta**
DD. *Ovary with short, soft hairs.* 4. **Tetralix**
AA. *Tender Heaths.*
B. *Fall-blooming.*
C. *Corolla club-shaped or funnel-shaped*...................... 5. **hyemalis**
CC. *Corolla widest at base, tapering to a much constricted neck.* 6. **præstans**
CCC. *Corolla globose, the lobes very short* .... 7. **gracilis**
BB. *Christmas-blooming.*
C. *Corolla lobes long and spreading* .... 8. **melanthera**
CC. *Corolla lobes long and revolute* 9. **fragrans**
CCC. *Corolla lobes short and rather erect*.........................10. **Wilmorei**
BBB. *Easter-blooming.*
C. *Fls. yellow*...................11. **Cavendishiana**
CC. *Fls. rosy to white.*
D. *Corolla tubular*............12. **cylindrica**
DD. *Corolla globose.*
E. *Lvs. in threes.*
F. *Fls. white*..............13. **persoluta**
FF. *Fls. rosy.* ....14. **Lusitanica**
EE. *Lvs. in fours*.............15. **cupressina**
DDD. *Corolla urn-shaped, i. e., longer than* DD, *and more constricted at the neck*....16. **Mediterranea**
DDDD. *Corolla ventricose, i. e., swelled at the base, and tapering slowly to a narrow neck* ....17. **ventricosa**
18. **translucens**

1. **cárnea**, Linn. (*E. herbàcea*, Linn.). Height 6 in.: lvs. in 4's: inflorescence lateral: corolla broadly bell-shaped: anthers exserted: ovary glabrous. Mar.–May. Alps. L.B.C. 15:1452. B.M. 11. Gn. 54:1177 (a charming picture). The bright rosy-fld. form is the best and most striking. There are pale red and pure white varieties. The most popular of all hardy Ericas. Very easily prop. by division. We should try *E. Mediterranea*, var. *hybrida*, Hort., said to be a cross with *E. carnea*, and in England thriving almost as well in loam as in peat. See Gn. 55, p. 125, and 54, p. 262.

2. **vàgans**, Linn. CORNISH HEATH. Lvs. in 4's or 5's: sepals small, ovate, obtuse; corolla ovate-bell-shaped; anthers ovate-oblong, 2-parted, exserted: ovary not hairy. W. Eu. and Medit.—Fls. pale purplish red. Grows 3–4 ft. in England; 1 ft. with J. W. Manning, Reading, Mass. Var. **álba** has white fls. Var. **capitàta**, grows 1–2 ft. high with Meehan at Germantown, Pa., and has "small whitish fls. with a purplish tip."

3. **stricta**, Don. CORSICAN HEATH. Lvs. in 4's, a little more erect than in Nos. 3 and 5: sepals lanceolate, obtuse; corolla ovoid-oblong, narrowed at the throat; anthers awl-shaped or awned, included: ovary densely covered with long, rough hairs. Corsica.—Attains 4 ft. in England, but grows 1–2 ft. high with Meehan, at Germantown, Pa. Branches strict, rigid.

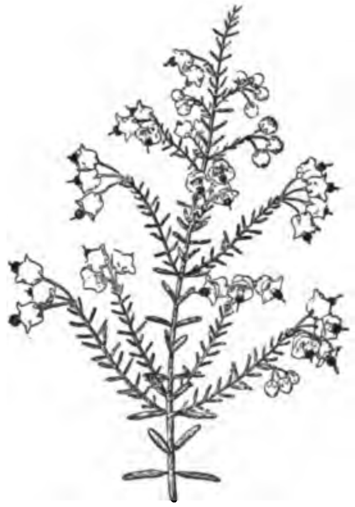
4. **Tetràlix**, Linn. BELL HEATHER. CROSS-LEAVED HEATH. Lvs. in 4's, margin folded back: fls. rosy; sepals ovate-lanceolate, ciliate; anthers awl-shaped or awned, included: ovary with short, soft hairs. W. Eu.—Foliage grayish. Height in England 6–12 in. With Manning, at Reading, Mass., about 8 in.

5. **hyemàlis**, Hort. Fig. 771. Written also *hiemalis*. Watson thinks it may be a winter-flowering form of *E. perspicua*, figured in L.B.C. 2:102 and 18:1778 as *E. Linnæana*. Fls. rosy pink, tipped white. Var. **álba** has white fls. With L. Dupuy, Whitestone, L. I., it flowers in Sept. G.F. 5:137. Gn. 41:856. H. D. Darlington says it is very distinct from *E. perspicua*.

6. **præstans**, And. (*E. Parmentièrii*, Loddiges). Lvs. in 4's, somewhat incurved: bracts crowded: fls. nearly sessile, white, faintly flushed pink at base, in terminal groups of 4 or more; sepals ovate, rough-margined; anthers scarcely acute. Sep. Varieties are pictured under various names in L.B.C., plates 154, 1695, 197 and 1804.

7. **grácilis**, Salisb. Lvs. in 4's, somewhat erect: bracts remote: sepals smaller, lanceolated; anthers with a short, sharp point. L.B.C. 3:244 (pale violet). "Fls. purplish red." Var. **autumnàlis**, Hort. Fls. Sep. Var. **vernàlis**, fls. in Oct. and Nov.

8. **melanthèra**, Linn. Fig. 772. Lvs. in 3's, obtuse, grooved on the back, younger ones often rough, with glands: bracts mostly crowded: fls. rosy; sepals obovate, keeled, colored; anthers black: ovary villous. Not L.B.C. 9:867, which may be a form of *E. nigrita*. Flowers in Dec. and Jan. A.F. 11:1133 and 12:579. F.E. 9:333.



772. Erica melanthera.

9. **fràgrans**, And., not Salisb. Lvs. opposite, erect-appressed, acute, always glabrous: bracts loose, sepal-like: fls. in 2's; sepals ovate, keeled, green: ovary glabrous or slightly bristly at the tip. Habitat? B.M. 2181. L.B.C. 3:288.

10. **Wilmorei**, Knowles & Westc. (*A. Wilmoreàna* and *Vilmoreàna*, Hort.). Hybrid: corolla tubular, bulged below the lobes, slightly velvety-hairy: fls. in 1's–3's, rosy, tipped white. R.H. 1892, p. 202. A.F. 4:251. G.C. III. 19:201.—Var. **glaúca**, Carr., has nearly glaucous foliage. Var. **calyculàta**, Carr., has a large additional calyx. R.H. 1892, p. 203. In England flowers in spring.

11. **Cavendishiàna,** Hort. (*E. Cávendishii,* Hort.). Hybrid of *E. depressa* × *E. Patersonii.* Lvs. in 4's, margins revolute: fls. in 2–4's; corolla tubular; stamens included; anthers awned. P.M. 13:3. G.C. 1845, p. 435. F.S. 2:142. A.F. 12:1143. Gng. 5:331. G.C. II. 18:213 and 20:597.

12. **cylindrica,** And. and Hort., not Wendl. or Thunb. Important hybrid of unknown parentage, cult. since 1800. Lvs. in 4's: fls. nearly sessile; corolla 1 in. long, brilliant rosy red, with a faint circle of dull blue about two-thirds of the way from the base; anthers awned, included: ovary glabrous. L.B.C. 18:1734. R.H. 1859, p. 42.—Fls. very showy and unusually long. The oldest *E. cylindrica.* That of Wendland is a yellow-fld. species unknown to cult.

773. A form of Erica persoluta.

13. **persolùta,** Linn. Fig. 773. Essentially a white-fld. and very variable species, particularly as regards hairiness. Lvs. erect or spreading, hirsute or glabrous: corolla small, originally 1½ lines long; lobes ovate, 2–3 times shorter than the tube, the sinuses acute, narrow. S. Afr. The numerous varieties Bentham found impossible to separate either in the wild or in cultivation. Var. **hispídula,** Benth. Slightly hirsute: lvs. 2½–3 lines long, rough: anthers subovate. Var. **lævis,** Benth. Lvs. shorter, blunter, often appressed, glabrous; anthers subglobose. Var. **subcárnea,** Benth., has the corolla lobes more evident. To this last variety Bentham seems to refer most of the horticultural varieties cult. under the name of *E. persoluta.* *E. assúrgens,* Link., he refers to the first variety; *E. Cáffra* of Linnæus to the first, but of L.B.C. 2:196 (and the trade?) to the second. *E. regérminans* of Linnæus is a distinct species (figured in L.B.C. 17:1614 as *E. Smithiana*); of the trade = *E. persoluta,* var. *hispídula;* of L.B.C. 18:1728 = *E. persoluta,* var *subcarnea.* Flowers in February and March, while the other species, numbered from 12–18, mostly flower in March and April.

774. Erica Mediterranea.

14. **Lusitanica,** Rudolph (*E. codonòdes,* Lindl.). SPANISH HEATH. Branches tomentose-pubescent: lvs. glabrous and ovary glabrous. W. Eu. B.R. 20:1698. G.C. II. 7:463; III. 19:487. I.H. 43, p. 321. Gn. 54: 1190; 55, p. 125.—Hardy in England, but not here.

15. **cupressina,** Forbes (*E. turrígera,* Salisb.). Lvs. glabrous, subciliate or naked: inflorescence terminal: fls. pedicelled, in 1–4's: bracts remote: sepals finally reflexed; sinuses of the corolla acute, narrow. Probably a hybrid cult. since 1802. F.E. 9:333.

16. **Mediterrànea,** Linn. (*E. cárnea,* var. *occidentàlis,* Benth.). Fig. 774. This is considered by Bentham a western form of *E. carnea* (No. 1), with a little smaller fls., corolla a trifle wider at the apex, and anthers shortly exserted instead of included. *E. Mediterranea* of the trade is hardy in England, and perhaps second only to *E. carnea* in popularity there. In America it seems to be cult. only under glass. B.M. 471. Gn. 54: 1190; 55, p. 403.

17. **ventricòsa,** Thunb. Lvs. in 4's, incurved to spreading, with pilose margins: inflorescence terminal: sepals keeled; anthers with 2 very short ears, or awned, included: ovary glabrous. B.M. 350. L.B.C. 5:431. Var. **grandiflòra,** with tubes over ½ in. long. L.B.C. 10:945. The following varieties are cult. by L. Dupuy: *Bothwelliana, breviflora, carnea rosea, cintra, hirsuta alba. magnifica, superba, tricolor.* See R.H. 1858, p. 450 and 1880:50. Gn. 45, p. 87. A.F. 10:1111. F.E. 9:333.

18. **translùcens,** Andr. Perhaps the first of all the garden hybrids between *E. tubiflora* and *E. ventricosa.* Lvs. rigid, with or without long, soft, red hairs: fls. in umbel-like heads; bracts remote; corolla rosy, 8–9 lines long; tube narrowly ventricose, pubescent: limb short, spreading: ovary sessile. Andr. Heaths, 295. Bentham considers this a synonym of *E. spuria,* Andr. Heaths, 60. Schultheis says "it is the finest Erica grown; a poor propagator but good grower. Takes 3 mos. to root."

The following are mostly kinds that have been grown successfully in small quantities by A. Schultheis but have never been advertised in American trade catalogues. H = hard-wooded; the rest are soft-wooded. S. Africa, unless stated.

E. ampullàcea, Curt. Lvs. ciliate, mucronate: bracts colored: fls. mostly in 4's; corolla ventricose, very sticky, typically white, lined with red, limb spreading, white. Var. rubra, Hort., is the only form cult. B.M. 303. L.B.C. 6:508. H.—*E. aristàta,* And. Readily distinguished by the long bristle which ends the lvs.: lvs. recurved: fls. in 4's; sepals keeled with red; corolla sticky, 1 in. long, ventricose, but with not so long and narrow a neck as in E. ampullacea. B.M. 1249. L.B.C. 1:73. H.—*E. barbàta,* And. Bristly and glandular-pubescent: lvs. in 4's: corolla urn-shaped, villous: ovary villous. L.B.C. 2:124.—*E. Bowieàna,* Lodd. Lvs. in 4–6's: inflorescence axillary: corolla tubular, slightly inflated: limb erect or scarcely open. L.B.C. 9:842.—*E. Burnétti,* Hort., not in Index Kewensis.—*E. conspícua,* Soland., is a species with club-shaped, villous fls. and villous lvs. in 4's. Var. splendens, Klotzsch, with the lvs. and sepals shining green and pubescent corollas, includes E. elata. And. L.B.C. 18:1788.—*E. Devoniàna* is not in Index Kewensis. H.—*E. elàta,* And. = E. conspicua, var. splendens.—*E. Irbyàna.* And. Allied to E. ampullacea, but with corolla narrower at the base and tapering with perfect regularity to just below the limb, where it has a prominent red bulge. It is also distinctly lined with red, and the sepals are green, though the bracts are colored, as in E. ampullacea. L.B.C. 9:816. H.—*E. nigréscens,* once advertised by Pitcher & Manda, is presumably E. melanthera (H. D. Darlington).—*E. pállida.* A confused name. The oldest plant of this name is Salisbury's, which has an urn-shaped corolla, fls. often in 3's, pubescent and hirsute branches and lvs. in 3's. L.B.C. 1:72 (as E. pura). *E. pállida* of the trade is probably the tubular-fld. hybrid of Loddiges in L.B.C. 14:1355, which has axillary and terminal fls., and lvs. in 4's to 6's.—*E. perspícua,* Wendl., has a tubular or slightly club-shaped corolla, lvs. in 4's, pubescent or rough hairy, and fls. in 1–3's, but the plant in the trade is probably *E. perspicuoìdes,* Forbes, a hybrid, with longer and woollier hairs, fls. somewhat in umbels, nearly 1 in. long. Only var. erecta is grown here.—*E. Syndriàna* is grown by Louis Dupuy.—*E. trícolor* is perhaps the most confused name in the genus, and apparently one of the important kinds abroad, where it has many varieties and synonyms. In the trade it seems to stand for a handsome Heath, with lvs. in 4's, distinctly ciliate and terminated by a bristle: fls. in umbels of 8–10, 1 in. long, a little too inflated at the base for the typical tubular form, rosy at the base, then white, then green, and then suddenly constricted into a short neck; pedicels red and exceptionally long. This description is from L.B.C. 12:1105 (as E. eximia), one of the earliest pictures of these charming hybrids which Bentham refers to the hybrid E. aristella, Forbes.

Those who expect to import Ericas from the Old World will be grateful to A. Schulteis for the following list of kinds which he has been unable to grow successfully at College Point, L. I.: Soft-wooded kinds, *E. cerinthoides, colorans, intermedia, mammosa, mirabilis;* hard-wooded, *jasminoides, Marnockiana.*

LOUIS DUPUY and W. M.

ERIGÈNIA (Greek, *spring-born*). *Umbelliferæ.* HARBINGER OF SPRING. A monotypic genus. *E. bulbòsa,* Nutt., is low, nearly stemless, hardy, from a deep-lying tuber, with ternately decompound leaves and small umbels of minute white flowers. A few plants may have been sold by collectors and dealers in native plants. B.B. 2:542. The Greek pronunciation of the word was Erigenìa, but usuage, euphony and analogy warrant the use of Erigènia.

L. H. B.

ERÍGERON (Greek, *old man in spring;* the young plants are somewhat hoary). *Compósitæ.* FLEABANE. The garden Fleabanes are hardy border plants, suggesting our native asters, but blooming much earlier, and growing in tufts like the English daisy, though usually from 9 in. to 2 ft. high. The genus has perhaps 100 species scattered over the world, particularly in temperate and mountainous regions. Stem-lvs. entire or toothed: fls. solitary, or in corymbs or panicles: rays in 2 or more series, mostly rose, violet or purple, rarely cream-colored or white, and one kind has splendid orange flowers.

The garden Fleabanes are practically all perennials. A few annuals are harmless and pretty weeds. Some species have roots that are biennial, but they increase by offsets, and make larger clumps from year to year. They are of easy culture. J. B. Keller finds that they do best when somewhat shaded from the midday sun. They are easily prop. by seeds or division, and doubtless by cuttings, if there were sufficient demand. Small, divided plants set out in early spring produce good-sized flowering plants the first year. A good show of bloom may be had from seeds sown outdoors as early as possible in spring. Some fine masses of these plants in the hardy border or wild garden are much more desirable than an isolated specimen or two of each kind. The most popular species is *E. speciosa*, of which double- and white-fld. forms should appear before long. At present it is the best kind, that has the rich, soft colors, from rose to violet and purple. *E. aurantiacus* has dazzling orange fls., and is unique in the genus.

A. *Fls. orange.*

aurantiacus, Regel. More or less velvety: height 9 in.: lvs. oval-oblong, clasping at the base, more or less twisted: heads one on a stem: involucral scales loose, reflexed. July, Aug. Turkestan. R.H. 1882:78. Gn. 52, p. 485.—Perhaps the showiest of the genus. Sold as "Double Orange Daisy."

AA. *Fls. creamy or white.*

B. *Lvs. linear.*

ochroleùcus, Nutt. Height 9–18 in.: stems mostly not branched: lvs. rather rigid: rays 40–60, white or purplish, never yellow. Gravelly hills and plains N. Wyo. and Mont. to Utah.—This and the next are rare kinds, sold by collectors and dealers in native plants, and not cult. abroad.

BB. *Lvs. broader, lanceolate to ovate, or obovate.*

Hówellii, Gray. Height about 1 ft.: root-lvs. obovate: stem-lvs. ovate, half-clasping: rays 30–35, 1–2 lines wide, white. Cascade Mts., Oregon.

mucronàtus, DC. Lvs. lanceolate, narrowed at base, ciliate, mostly entire, often with a long, callous mucro. Mex. J. B. Keller cultivates a lilac-fld. plant from the Himalayas as *E. mucronatus*, which he says is the same as *Vittadenia triloba*, which see.

AAA. *Fls. rosy, violet or purple.*

B. *Rays 100 or more, mostly narrow: lvs. entire.*

C. *Flower-heads large.*

D. *Involucre hairy.*

E. *Height about 2 ft.: stems several-fld.*

speciòsus, DC. (*Stenáctis speciòsa*, Lindl.). Height 1½–2 ft.: hairs few, loose: stem very leafy at top: root-lvs. more or less spatulate: stem-lvs. lanceolate, acute, half-clasping. B. C. to Ore. near the coast. B.M. 3606. B.R. 19:1577. Gn. 52:1149. Var. **supérbus**, Hort., sold abroad, has lighter colored and more numerous fls. Var. **màjor**, Hort., has broader rays and brighter colors.

EE. *Height 9–15 in.: stems usually 1-fld.*

glaùcus, Ker-Gawl. Lvs. slightly glaucous: root-lvs. rarely 2–3-toothed. Pacific coast, where it flowers most of the year. B.R. 1:10. Gn. 52, p. 484.

DD. *Involucre not hairy.*

macránthus, Nutt. Height 10–20 in.: hairs numerous and long or short, sometimes nearly absent: lvs. lanceolate to ovate. Rocky Mts. Wyo. to New Mex. and S. W. Utah. Gn. 52, p. 484.—A good species. Blooms later than the eastern species. Violet. Hardy.

CC. *Flower-heads (or disk) small.*

glabéllus, Nutt. Height 6–20 in.: root-lvs. spatulate: stem-lvs. lanceolate, gradually narrowing into bracts: involucre bristly, or at least pubescent: rays violet-purple or white. Minn. to Rockies. Gn. 52, p. 485. B.M. 2923. B.B. 3:385. L.B.C. 17:1631.—Cult. by D. M. Andrews, Boulder, Colo. Much cult. abroad.

BB. *Rays 70 or less, wider: lvs. entire or toothed.*

C. *Lvs. almost or quite entire.*

D. *Stems with several fls. in a corymb.*

Villársii, Bell. Root biennial: height 1 ft.: lvs. with 3 or 5 nerves, roughish: fls. corymbose. Eu. B.R. 7:583. L.B.C. 14:1390. Not cult., but in I.H. 43, p. 301, said to be a parent with *E. aurantiacus* of *E. hybridus roseus*, Hort., Haage & Schmidt. This is said to resemble *E. Villarsii* in habit, and *E. aurantiacus* in form of fls. but not in color. Said to bloom freely from May to autumn.

DD. *Stems mostly 1-fld.*

salsuginòsus, Gray. Height 12–20 in.: upper stem-lvs. with a characteristic mucro. The slightly viscid character of the involucre is particularly designative. Wet ground, on higher mountains, Alaska to Calif. and New Mex. B.M. 4942.

CC. *Lvs. coarsely toothed above the middle.*

bellidifòlius, Muhl. POOR ROBIN'S PLANTAIN. Makes new rosettes by offsets from underground stems: height 2 ft.: root-lvs. wider above the middle than in most species: stem-lvs. fewer: fls. spring. Damp borders of woods. Canada to Ill. and La. B.M. 2402. B.B. 3:388. D. 237.—"Fls. clear blue, on long stems."—*J. W. Manning.* Weedy.

E. purpùreum, Hort., according to H. A. Dreer, "rarely exceeds 10 in. in height, and has medium-sized fls. of soft, rosy purple, borne in graceful, spreading panicles." Form of *E. macranthus*?

W. M.

ERÌNUS (a name derived from Dioscorides). *Scrophulariàceæ.* The most popular species of this small genus is a hardy, tufted plant 3 or 4 in. high, suited for steep sides of alpine gardens, where it produces in spring its racemes of small purple, rosy or white fls. Root-lvs. crowded, opposite: stem-lvs. alternate, oblong-spatulate, with a few coarse, rounded teeth: corolla lobes 5, obovate, the 2 upper ones slightly smaller: stamens 4, in two groups, included.

The secret of success in alpine gardens is said to be a constant supply of moisture with perfect drainage. As a class, alpines are impatient of standing water, and Erinus, which is a favorite, particularly so. J. B. Keller writes that Erinus should be planted in steep parts of the rockery where water cannot lodge on rainy days or in the winter and spring months. He adds that they need slight shade from midday sun. Divided plants are chiefly sold in America, but the amateur can soon produce a good carpet by the use of seeds. When well established, the seeds are self-sown and the offspring gain in hardiness. It may be safest to keep a pot or two in a coldframe over winter, until the plant can take care of itself. In England, seeds can be sown in earthy holes of brick walls, and Gn. 45, p. 134, shows a charming picture made by informal masses of flowering Erinus naturalized on some old stone steps.

alpìnus, Linn. Lvs. hairy: racemes 2½ in. long: fls. ½ in. across, purple. April–June. Mountains of W. Eu. B.M. 310.—Vars. **álbus** and **carmineus**, Hort., have white and crimson fls. respectively.

The following trade names are accounted for in Zaluzianskia: *E. duplex, gracilis, Paxtoniana* and *speciosa.*

W. M.

ERIOBÒTRYA (Greek, *woolly cluster*). *Rosàceæ.* Ten or twelve species, mostly East Asian, have been referred to this genus, but some authors restrict it to the one species described below, and others refer all the species to Photinia. Fls. large, white, fragrant, in a terminal rusty-woolly cluster; calyx thick, 5-toothed; petals 5, crenulate: ovary 3–5-loculed, each locule 1-ovuled.

Japónica, Lindl. (*Photínia Japónica*, Gray). LOQUAT. JAPAN PLUM and MEDLAR (erroneously). Small tree, 10–20 ft., with thick, evergreen, oval-oblong remotely-toothed lvs. near the summits of the branches;

the under surface rusty-tomentose: fr. a pear-shaped yellow pome (Fig. 775), with large seeds and an agreeable acid flavor. B.R. 5:365. A.G. 12:19.—The Loquat is native to China and Japan, but is much planted in the Gulf states and westward. It blooms from Aug. until the approach of winter, and ripens its clustered fr. in very early spring. The fruit is often seen in northern markets. It is a profuse bearer in congenial climates.

775. Loquat (×¾).

Loquat is an excellent decorative plant, either as an evergreen lawn tree south of Charleston, or as a pot-plant in the North. Grown from seeds, it is a most satisfactory conservatory subject, resisting uncongenial conditions. L. H. B.

ERIOCNÈMA. Consult *Bertolonia.*

ERIODÉNDRON (Greek, *woolly tree;* alluding to the woolly fiber inside the fruit, called "ceibo" and "pochote" by the Mexicans, and used by them for stuffing pillows). *Malvàceæ.* Ten species of tropical trees, thorny or not: lvs. digitate; leaflets 3–7, entire: fls. solitary or clustered, large or medium-sized, rosy or whitish; petals oblong, pubescent or woolly; column of stamens with 5 branches at the top, each bearing 2–3 anthers. **E. occidentàle,** G. Don, is cult. by Franceschi, Santa Barbara, Calif., as *Ceiba occidentalis.*

ERIÓGONUM (Greek, *woolly joints*). *Polygonàceæ.* About 100 species, chiefly northwest American herbs, tufted subshrubs, or slender annuals, mostly densely woolly: lvs. crowded at the base of the stem, alternate, entire. *E. compósitum,* Dougl., perhaps the best known, has countless minute 6-lobed neutral colored fls., dull white to rosy, borne in compound umbels 5–6 in. deep and broad. The following have been advertised, but are practically unknown in our gardens: *E. campanulàtum, compósitum, flàvum, heracleoìdes, incànum, microthècum* var. *effùsum, nìveum, nùdum, ovalifòlium, sphærocéphalum, thymoìdes, umbellàtum.* These kinds have been advertised by D. M. Andrews, Boulder, Colo., E. Gillett, Southwich, Mass., and F. H. Horsford, Charlotte, Vt. Consult American manuals and floras, and Proc. Am. Acad., vols. 8, 12 and 14. Should these attain any garden importance they may be reviewed in an annual continuation of this work. Species are usually found on calcareous soils. W. M.

ERIÓPHORUM (*wool-bearing,* from the Greek; alluding to the heads of fruit). *Cyperàceæ.* Perennial rush-like plants, growing in swales: fls. in dense heads, the bristles very numerous and often becoming greatly elongated in fruit. None of them is known in cult., but the following have been offered by collectors: *E. alpìnum,* Linn.; *E. cyperìnum,* Linn.; *E. lineàtum,* Benth. & Hook.; *E. polystàchyon,* Linn.; *E. vaginàtum,* Linn.; *E. Virgínicum,* Linn. All these are wild in the northern states. Useful for bog gardens. Avoid late fall planting.

ERIOPHÝLLUM (Greek, *woolly-leaved*). *Compósitæ.* Perhaps a dozen species, all from western N. Amer. One kind cult. in a few hardy borders is a low, tufted, herbaceous perennial, with much divided lvs., covered with wool beneath (each stem bearing about 5), and 8-rayed, yellow heads, 2 in. across, borne in a loosely forking fashion on peduncles 3–7 in. long. The genus was included in Bahia by Bentham and Hooker, but is now kept distinct largely because of the permanently erect involucral bracts: seeds mostly 4-angled, and pappus of nerveless and mostly pointless, colorless portions.

cæspitòsum, Dougl. (*Actinélla lanàta,* Pursh, not Nutt. *Bahia lanàta* DC.), described above, has been advertised by E. Gillett. B.R. 14:1167 is badly drawn as to involucre and pappus.

ERIÓPSIS (Greek, *like Eria,* an orchid of the Epidendrum tribe, which it resembles when not in flower). *Orchidàceæ.* Five Peruvian orchids of the Vanda tribe allied to Acacallis and Warrea. Lvs. plicate; racemes 2 or 3, basal: fls. open, small, maxillaria-like, together: lip 3-lobed, the lateral lobes broad and erect. Cool house orchids, requiring the treatment of Cattleya.

bìloba, Lindl. Pseudobulbs 3 inches long: lvs. lanceolate: fls. 1 in. across; sepals and petals yellow, with orange-red margins; labellum yellow spotted with brown. Colombia. B.R. 33:18.

rutidobúlbon, Hook. Stouter in habit than the above: pseudobulbs wrinkled, dark colored: racemes drooping: sepals and petals orange-yellow, with deeper colored margins; labellum white, with purple spots. Antioquia, in exposed positions on the stems of palms. Peru. B.M. 4437.

Hélenæ, Kränzlin. Said to be "the finest in this small and rare genus. It differs greatly in habit from the other members; the bulbs somewhat resemble those of *Epidendrum Brassavolæ,* but are much stronger, and bear three long, coriaceous, dark, glossy, green leaves. The flowers are twice as large as those of *E. biloba,* and are borne on tall, arching scapes. The sepals and petals are orange-colored, margined with purple, the lip similar, but with a yellow blotch, spotted with purple at the base."—*Sander & Co.,* 1899. OAKES AMES.

ERIOSTÈMON (Greek, *woolly stamens*). *Rutàceæ.* Coolhouse evergreen shrubs from Australia, with starry, 5-petaled fls. an inch wide, of white or blush pink. Practically unknown in America, but abroad considered amongst the finest of hard-wooded winter or spring-blooming Australian plants. The nurserymen mostly graft them on stocks of Correa, an allied genus, which has tubular fls. instead of free petals. Lvs. alternate, entire, glandular-dotted: stamens 8–10, free, shorter than the petals; anthers pointed. Much care is needed to produce well-trained specimens. With the growth of wealth in America, more of the Australian hard-wooded plants will be grown by skilled gardeners in our finer establishments. The following kinds can be imported from Europe.

A. *Foliage linear or narrowly lanceolate.*

B. *Lvs. linear.*

scàber, Paxt. Lvs. covered with minute roughnesses: petals white, tipped pink. P.M. 13:127.

BB. *Lvs. narrowly lanceolate.*

linifòlius, Seghers. Lvs. broadest at middle, tapering both ways. R.B. 20:97.—Probably an old garden form of some well-known species.

AA. *Foliage conspicuously wider.*

B. *Lvs. 10–12 times as long as broad.*

C. *Apex abruptly pointed.*

myoporoìdes, DC. Lvs. widest at the middle, tapering evenly both ways: petals white, glandular on the back. B.M. 3180.

CC. *Apex blunt.*

salicifòlius, Sm. This willow-leaved species has perhaps the handsomest foliage. Lvs. widest above the middle, tapering more gradually to the base than to the apex: petals bright, soft pink. B.M. 2854.

BB. *Lvs. 3–4 times as long as broad.*

intermèdius, Hook. Lvs. 9–18 lines long, elliptical, abruptly pointed: petals lanceolate, white, but tipped with pink outside in the bud like the rest: ovary placed on a flat disk and not ringed at the base. Probably of garden origin. Intermediate between *E. myoporoides* and *buxifolius*. B.M. 4439.

buxifòlius, Sm. Lvs. as in *E. intermedius*, though perhaps smaller: petals obovate, white, tipped pink: ovary sunk into a double disk of 2 rings. B.M. 4101.—*E. densiflòrum*, Seghers., R.B. 20:97, looks like a prolific horticultural variety of this species. W. M.

ERITRÍCHIUM. For *E. barbigerum*, see *Krynitzkia*. For *E. nothofulvum*, see *Plagiobothrys*.

ERÒDIUM (Greek, *a heron;* alluding to the beaked fruit). *Geraniàceæ.* HERON'S BILL or STORK'S BILL. This genus contains a few low-growing, hardy herbaceous perennial plants, with finely cut foliage and fls. suggesting our wild and hardy Geraniums, from which they differ in having only 5 instead of 10 anther-bearing stamens, the other 5 being reduced to scales; also the tails of the carpels hairy inside. The common Geraniums of our home windows and summer flower-beds are the blended product of *Pelargonium zonale* and *P. inquinans*, and originally had the 2 upper petals distinctly smaller than the 3 lower ones, as do the other wild Pelargoniums from the Cape of Good Hope, while Erodium and the true genus, Geranium, of which a few sorts are cultivated in our hardy borders, have all 5 petals nearly equal in size. They also have small glands alternating with the petals, which are absent from Pelargonium. Erodium has about 50 widely scattered species. Herbs, rarely somewhat woody or tufted: lvs. opposite or alternate, one often smaller than its mate, stipuled, toothed, lobed or dissected: fls. mostly in umbels, of various shades, from crimson-pink to purple, with darker blotches on the 2 upper petals and the venation outlined in darker shades.

These plants are chiefly for the front row of the hardy borders and the rock-garden, where they thrive in a gritty loam. They like dry, sunny spots, and may be trusted with a conspicuous position, being chiefly valued for their steady succession of bloom from June to August. Divided plants are chiefly sold here, but the species are easily prop. by seeds. Of *E. moschatum* only seeds are sold, and these are sown annually, the species not being hardy. Nos. 1 and 4 are not native to America, being essentially Asian, but they grow wild in California and to some extent in eastern states. Some Erodiums can be grown in chinks of walls, but not *E. Mànescavi*, which is the strongest-growing, showiest and best kind.

1. **cicutàrium**, L'Hérit. Tufted, lower and more slender than No. 4, less glandular, often with coarse, soft, short hairs: lvs. oblong, 1–2-pinnate; lfts. small, nearly sessile, the uppermost confluent, more sharply and deeply cut and with narrower lobes: stipules small, acute: sepals with 1 or 2 terminal bristles: filaments not toothed. Mediterranean regions, Asia. Mn. 7, p. 127.

2. **macradènium**, L'Hérit. Remarkable for the great length of the roots when twisting among rocks, and strong odor of the foliage. Lvs. hairy, glandular, 1½–2 in. long, oblong, pinnate; segments pinnatifid, rachis with a toothed wing: fls. light purple, the 2 upper petals a shade darker, and the spots nearly black. Pyrenees. B.M. 5665.

3. **Manescàvi**, Coss. Height 10–18 in.: lvs. attaining 6 in. long, 2½ in. wide; segments alternate, ovate, short-stalked, dentate, with sometimes a deeper cut: fls. at best 2 in. across, strong rosy purple, the spots of the upper petals only a shade or two darker. Pyrenees. Gn. 55:1220.—Colors stronger and more uniform than No. 3.

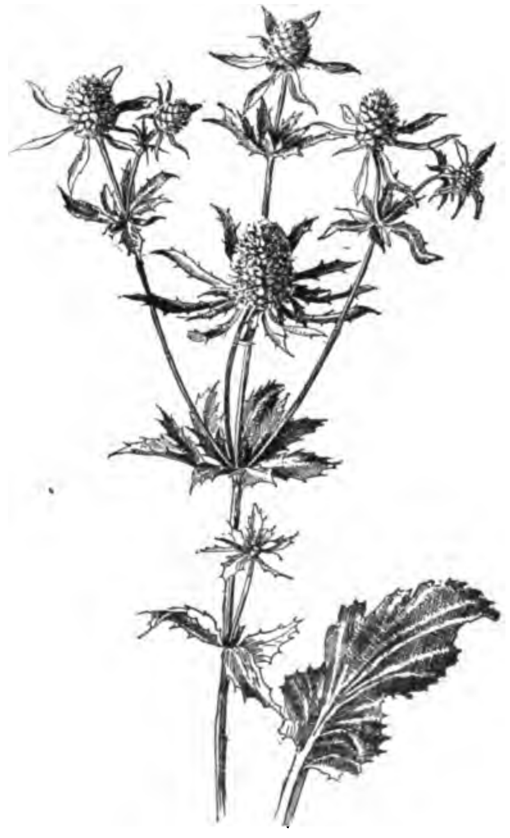
4. **moschàtum**, L'Hérit. Mostly stout and glandular: lfts. large, short-stalked, ovate to elliptical, serrate, broad-lobed: stipules large, rather obtuse: sepals not terminated by bristles: filaments 2-toothed. Mediterranean, Orient. W. M.

ERPÈTION. All referred to *Viola*.

ERÙCA (etymology in dispute; probably from the Latin *to burn*, in allusion to the hot seeds). *Cruciferæ.* Perhaps half a dozen herbs of Eu. and W. Asia, annual or biennial. Allied to Brassica: differs in the shorter, more turgid silique, with keeled valves; style elongated; seeds in two rows. **E. sativa**, Mill., Roquette or Tira, is the only species cult. in this country. It is a weedy, hispid annual, resembling a Mustard, 2–3 ft. high, with lyrate-pinnatifid lvs. and creamy yellow fls. See *Roquette*. L. H. B.

ERÝNGIUM (a name used by Theophrastus for some sort of thistle). *Umbelliferæ.* SEA HOLLY. The Sea Hollies are among the most bizarre of garden plants, and are chiefly valued for the steel-blue or purplish cast of their rigid stems, prickly foliage and teasel-like heads. They look like thistles, and do not suggest any relation to the umbelliferous family of which the flat-topped, white-flowered umbels of wild carrot are a common example. The genus has perhaps 100 species, mostly spiny herbs. The petals are white. All those described below are perennial.

The Sea Hollies are too queer and striking to be used as elements in the most restful and natural home-pictures, and their proper place is the hardy border, the natural repository for all sorts of curious things. Here they perpetually challenge one's curiosity and interest. There are two very distinct groups of them, one with much-cut foliage, as shown in Fig. 776, the other the "Pandanus group," with long, undivided leaves. A very different list of species is cult. abroad, but the main types are here now, and a collection of kinds is not as artistic as well massed groups of a single kind. They are slightly used in subtropical bedding. The dried stems retain their color, and are sometimes hung



776. Eryngium amethystinum.

up in living-rooms. The plants mostly grow from 2–3 ft. high and head out in July and Sep. J. B. Keller advises a light soil and sunny situation. *E. amethystinum* is probably the favorite. Meehan says that *E. planum* is much visited by bees. The weak point of Eryngiums is that they are slow to recover from the shock of division. This makes it difficult to work up a stock at home sufficient to make an effective group. D. Dewar, in his garden monograph of the group, Gn. 46, p. 522, says that the only safe way to increase the Sea Hollies is by seed. "Sow the seed in pans as soon as gathered, and place in a coldframe. The seeds will germinate in the spring, and if properly managed will be ready to plant out the following year." It is said that many of the species are less showy and satisfactory here than in England.

A. *Lvs. divided into radiating segments.*

B. *Bracts longer than the heads.*

C. *Number of bracts 10–20.*

D. *Root-lvs. deeply notched at the base and merely toothed at the margin.*

1. **alpinum,** Linn. Bracts 10–20, a little longer than the oblong heads. Alps. R.H. 1876, p. 113. B.M. 922. Gn. 46:993.—There is a white variety.

DD. *Root-lvs. less deeply notched at the base, elsewhere more dissected.*

2. **Oliveriànum,** Laroch. Bracts 10–12, more rigid and fewer-toothed than in *E. alpinum:* heads ovate. Orient. Gn. 45, p. 223.

CC. *Number of bracts 6–9.*

D. *Root-lvs. deeply cut.*

3. **amethýstinum,** Linn. Fig. 776. Root-lvs. pinnatifid: bracts 7–8, few-toothed at the base, much longer than the globose heads. Eu. Gn. 46, p. 522, and 55, p. 454. *E. cælestinum*, a trade name unknown to our botanies, is the same thing, according to J. B. Keller.

DD. *Root-lvs. merely crenate-dentate.*

4. **gigantèum,** Bieb. Root-lvs. deeply cordate: bracts 8–9: head ovate. Armenia. Gn. 46, p. 523.

BB. *Bracts as long as or shorter than the heads.*

C. *Upper stem-lvs. 5-parted.*

5. **plànum,** Linn. Middle stem-lvs. stalkless, undivided: bracts 6–7: head rotund. Eu., N. Asia.

CC. *Upper stem-lvs. about 8-parted.*

6. **Léavenworthii,** Torr. & Gray. Height 1–3 ft.: stem-lvs. stalkless, somewhat clasping: heads ovoid-oblong. Kans. to Tex., Mex. B.B. 2:522.

AA. *Lvs. undivided, long and linear.*

7. **aquáticum,** Linn. (*E. yuccæfòlium*, Michx.). Height 2–6 ft.: stem striate, unbranched or branched above: lvs. mostly clasping, finely parallel-veined, lower sometimes 3 ft. long, 1½ in. wide, all bristly margined: heads globose-ovoid. U. S. B.R. 5:372. W. M.

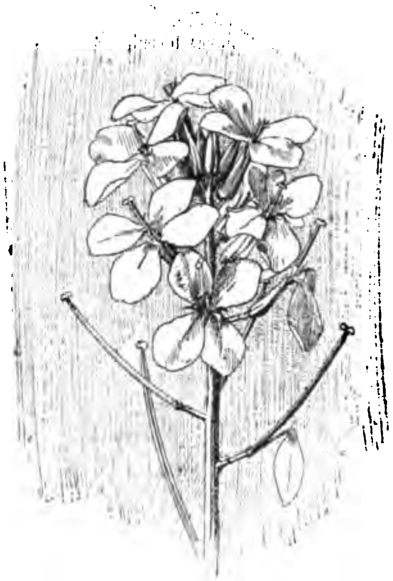
777. Erysimum asperum.

In No. 1 the involucre is a deeper blue than in Nos. 2–5; in No. 7 the involucre is not colored and the fls. are white or pale. No. 1 needs deep soil and partial shade. No. 3 also makes a good bog plant. No. 7 grows well in either wet or dry situations. Heights of the first five species, 2–3 ft.; 3–5, 2–3½; 3–4, 3–4.

F. W. BARCLAY.

ERÝSIMUM (possibly means blister-drawing). *Cruciferæ.* Of this big genus we cultivate two brilliant yellow and orange, spring- and summer-blooming, hardy "annuals," scarcely, if at all, inferior to the true wallflowers (Cheiranthus) for general purposes, and two lower-growing and perhaps earlier-blooming rock-garden plants. The genus has 70–100 species of biennial and perennial herbs, with long, soft, appressed, 2-parted hairs: lvs. narrow, linear or oblong, entire or variously toothed: fls. orange or yellow, rarely purple, often fragrant; petals 4: style persistent.

Although the two most popular kinds are biennials, the gardeners think of them as annuals. Their seeds can be sown in the fall and produce earlier bloom than if sown in spring. Fig. 777 shows the last flowers open at the top of the pyramid, while the seed pods are swelling below.



778. Erysimum asperum (×⅔).

The rockery kinds, J. B. Keller writes, do well also in the front row of the border and on dry banks. They like full exposure to sunlight, and in the spring months are completely covered with bright flowers. Divided plants only, not seeds, are offered by American dealers. In Gn. 24, p. 462, it is said that *E. ochroleucum* on level ground is likely to lose its lower lvs. and to perish on heavy soils in hard winters. It thrives best when frequently divided, and may be prop. by cuttings.

A. *Plants biennial: height 12–18 in.*

B. *Fls. yellow.*

ásperum, DC. (*E. Arkansànum*, Nutt.). Figs. 777, 778. Height 1–3 ft. in the wild, 12–18 in. in gardens: lvs. dentate or entire, upper ones mostly entire: fls. ½ in. across: pods rough, 1½–4 in. long, 4-sided, nearly erect. U. S. *E. Arkansanum* is merely a western and broader-leaved form. B.B. 2:152.

BB. *Fls. orange.*

Perofskiànum, Fisch. & Mey. Pods shorter than in the above, and standing out more nearly at right angles, not so stiff and straight, constricted below the narrower style. Caucasus, Afghanistan. B.M. 3757. P.M. 6:245.—There are strains of seed saved by Vilmorin-Andrieux & Co., from compact and dwarf plants suitable for edgings. (*E. Perofskianum nanum*, R.B. 32:101. *E. nanum compactum aureum*, Gt. 46, p. 194. *E. compactum aureum*, Peter Henderson & Co.).

AA. *Plants perennial: height mostly 4–6 in.: rock-garden plants.*

rupéstre, DC. (*E. pulchéllum*, J. Gay). Stem rather woody at base: lvs. somewhat dentate; stem-lvs. oblong, the hairs short, dense, 2–3-parted. Asia Minor. R.H.

1880, p. 412.—Woolson, Passaic, N. J., keeps the names separate. His plants of *E. rupestre* have "citron-yellow fls." *E. rupestre* is "more spreading."

ochroleucum, DC. (*E. Rhæticum*, DC.). Height 4–12 in.: stems yellowish, creeping: lvs. entire or the upper with a few short, sharp teeth. Spain. J. W. Manning's plants of *E. Rhæticum* he considers same as *E. pulchellum*. They "grow 6 in. high, and have bright yellow fls. in May." Woolson's plants of *E. ochroleucum*, "from the Alps of Jura," have pale yellow fls. W. M.

ERYTHÈA (one of the Hesperides, Daughter of Evening). *Palmàceæ*, tribe *Coryphеæ*. Spineless palms with solitary robust candices, ringed at the base, clothed above with dead leaf-sheaths. Leaves terminal, the younger ones tomentose, orbicular, flabellately many-parted, the lobes lacerated at the apex, intermingled with fibers, infolded; rachis short; ligule long; petiole stout, smooth or spiny along the margins; spadices long, white tomentose: branches stout; spathes many, sheathing the peduncle, thick-coriaceous, densely tomentose; bracts and bractlets distinct; fls. pale: fruit globose, small. Species 2. Southern California.

This small group of American palms includes two species only, as far as known at present, these being *E. armata*, which is known locally as the "Blue Palm," and *E. edulis*, the latter commonly known as the "Guadalupe Palm," from the fact that it has only been found in a wild state on the island of Guadalupe, off the coast of southern California. The plants in question belong to the fan-leaved section of palms, and bear much resemblance to Brahea, the segments of the leaves being adorned with whitish filaments. In the gardens of Santa Barbara, California, the Erytheas are planted out, and in a few years form very handsome trees, but in less favored latitudes they may be cultivated in the same manner as Kentias or Latanias, flourishing in a night temperature of 60° when grown in a rich and open soil and abundantly supplied with water.

armàta, Wats. (*Brahèa armàta*, Wats.). BLUE PALM. Tall and slender, 40 ft. high: lvs. very glaucous; petiole narrow, deeply channeled, margined with numerous stout, more or less hooked, slightly spreading spines; segments 30–40, sub-lacerate at the apex, slightly filiferous. Lower California. G.C. III. 20:425.

édulis, S.Wats. (*Brahèa édulis*, Wendl.). Stem 30 ft. high, 15 in. thick, with thick, corky bark; sheaths fibrous, at length glabrous; petioles stout, 1 in. wide, plano-convex, unarmed on the acute margins, fibrous-pubescent or glabrate above; ligule 2–3 in. long, densely silky-tomentose; blade 3 ft.; segments 70–80, at first tomentose, lacerate at the apex and fibrous on the edges. California. R.H. 1893, p. 297, and 1897, p. 77. G.C. III. 13:507; 22:157. JARED G. SMITH and W. H. TAPLIN.

ERYTHRÆA (Greek, *red;* alluding to the fls. of some species). *Gentianàceæ*. This includes two hardy plants with bright, deep rose fls., one of which is a rockery plant from the Azores, the other a Californian annual which deserves general cultivation. The flowers have slender green tubes an inch long, and a spreading limb of 5 oblong lobes, each half an inch long. The style of *E. venusta* is curious. Though longer than the stamens, it does not stand above them, but bends down and stands off at one side. The genus has possibly 30 widely scattered species, and no near allies of garden value. These plants bloom in summer and autumn.

Of *E. diffusa*, J. B. Keller writes: "A light, sandy loam, in a protected nook of the rockery, with partial shade, is required for this charming little alpine plant. It must be planted in a well sheltered position, and requires protection from sun and severe frost in winter, but the little plant is well worth all the extra care we may have to expend on it in winter. Prop. by cuttings, seeds or division."

Mássoni, Sweet (*E. diffùsa*, Woods). Height 4 in.: stems ascending, tufted, not branched above, 1–3-fld.: fls. lateral. Azores. Annuals in Azores, biennial in western Europe.—The plant cult. under this name is considered perennial by our nurserymen.

venusta, Gray. Height 6–10 in.: stems erect, 4-angled, cymosely branched, as many as 14-fld.: lvs. ½–1 in. long, oblong or ovate oblong, very blunt: corolla lobes said to be yellow at the base, but in the picture the fls. have a white eye. Calif. B.M. 6396.—The largest flowered species.

ERYTHRÌNA (from Greek for *red*). *Leguminòsæ*. CORAL TREE. Herbs, shrubs or trees, with large and showy papilionaceous fls., represented by 25–30 species in tropical countries. Lvs. pinnately 3-foliolate, with glanduliform stipules. Fls. mostly red and in dense racemes; calyx 2-lipped; standard free or very nearly so; tenth stamen free, or united only half its length: fr. a slender, more or less twisted pod. Plants usually spiny; very rapid growers. Erythrinas are much prized garden plants. Some of them, particularly the herbaceous kinds, are frequently planted out in the summer. In the house they demand an intermediate temperature. Give rich soil and frequent waterings. In the woody species, aim to have well-ripened wood for flowering, for the bloom is produced on wood of the preceding year. The herbaceous species are propagated by division of the rootstock; also by cuttings from shoots springing from the old roots. Woody species prop. by cuttings of growing wood. All species prop. by seeds, whenever these are obtainable.

A. *Herbaceous species (or treated as such)*. These die down at the end of the season, and the roots may be stored after the manner of Dahlias. It is best to start the roots before planting them out, particularly in the N. In their native countries, these species are more or less woody.

Crista-gálli, Linn. (*E. laurifòlia*, Jacq.). COMMON CORAL TREE. Bushy and woody, sometimes developing a very short trunk, but the flowering branches dying back after blooming, the stronger branches coming annually or periodically from near the root: stem and petioles somewhat spiny: lfts. ovate-oblong or lance-oblong, acuminate, entire: fls. large, brilliant crimson, the keel nearly as long as the down-folding standard, the wings rudimentary. Braz. B.M. 2161.—Runs into many forms, varying in the shade of red, some of them with variegated lvs. South of Washington, stands out of doors if protected. In the North the fleshy roots are taken up and stored. Valuable for summer bloom. Fls. in large, terminal racemes. Madame Belanger is a popular garden form.

compácta, Bull. Of very compact habit: fls. rich crimson. Probably a form of the last.

speciòsa, Andr. Bush-like, reaching 8–12 ft., but usually cut back as *E. Crista-galli* is: stems and lvs. prickly: lfts. broad and more or less 3-lobed, pointed, veiny: fls. in pubescent racemes, rich crimson. W. Ind. B.R. 9:750.—Stem green, very prickly.

herbàcea, Linn. Stems several and herbaceous, from a very thick root, 2–4 ft. high, the flowering ones nearly leafless: lfts. ovate to hastate: petioles long, more or less prickly: fls. 2 in. long and very slender, deep scarlet, in loose racemes 1–2 ft. long: seeds scarlet. N. Car. to W. Ind. Common on Gulf coast of Ala. and Miss. B.M. 877.—**E. Bidwillii**, Lindl., is a beautiful hybrid of this species and *E. Crista-galli* (the latter the pollen parent), with herbaceous shoots and an ascending vexillum. B.R. 33:9.

AA. *Woody or tree-like species*. Greenhouse plants, or planted in the open in S. Calif. and S. Fla.

Humeàna, Spreng. (*E. Cáffra*, Hort.). Often tree-like and 30 ft. or more, the stem and petioles very spiny: petioles long: lfts. rhomboid-ovate, acuminate: peduncles axillary and strictly erect, longer than the lvs., white-warty: fls. verticillate-spiked on the ends of the peduncles, long and slender, deflexed, brilliant scarlet fading to purple. S. Afr. B.M. 2431. B.R. 9:736.

Corallodéndron, Linn. CORAL TREE. Tree, prickly: lfts. ovate-rhomboid: calyx teeth obsolete; standard erect, linear-oblong, scarlet: seeds scarlet, usually with a black spot. W. Ind.

Other Erythrinas have been introduced into S. Calif.: *E. Bogoténsis*, said to grow 50 ft. high, from Colombia; *E. insignis*, Todaro, of unknown habitat, 100 ft.; *E. vidrum*, Todaro, 100 ft., of unknown habitat.

L. H. B.

ERYTHROCHÈTE, or **ERYTHROCHÈTON**. See *Senecio Japonicus.*

ERYTHRÒNIUM (from the Greek word for *red*). *Liliàceæ.* DOG'S-TOOTH VIOLET. ADDER'S TONGUE. Handsome plants of the north temperate zone. Four belong to the Old World, four to eastern N. America, one is found in the Rocky mountains, while in the cool woods and high mountains from northern California to the British possessions the genus is represented by nine species and a number of well marked varieties. Erythroniums have bulbs standing erect and from oblong to linear in form, two radical leaves, which in most species are handsomely mottled: scape slender and leafless, producing from one to many flowers. The perianth consists of six similar divisions, usually recurved, six stamens and a single 3-lobed style. The species are confused and are much in need of revision. See Watson, Proc. Amer. Acad. Arts & Sci. 14:260; 22:479. Baker, Journ. Linn. Soc. 14:296. Weathers, G.C. III. 20:361.

779. Erythronium Americanum (×½).

The Erythroniums are most interesting spring flowers. They succeed in any light soil, particularly in partial shade. In common with all herbaceous perennials, especially those which produce bulbs or corms, they profit by a winter mulch of leaves or litter. The western Erythroniums are all plants of the cool woodlands, except a few which grow at such altitudes as to reach like conditions. They thrive best in shade, a thoroughly drained soil, moist and rich in mold, a surface covering of half rotten leaves tending to equalize conditions. Any good fibrous material, as fibrous peat, cocoanut fiber or spent tan bark, or even well rotted sod, will answer the purpose to lighten the soil and give that abundance of mold they delight in. Pockets in shaded rockwork give ideal situations. They will thrive naturalized on cool, wooded slopes, and where the drainage is good will thrive in grass. The leaves ripen before the grass is cut and the effect is very fine. Simply planted in boxes in a loose soil, rich in mold, and left year after year in a shaded spot, they sometimes give splendid bloom. *E. Hartwegii* flowers very early, and stands more heat and dryness than any other variety. *E. purpurascens* and *E. montanum*, from high altitudes, tend to throw up their growth very late, and are on that account rather difficult to cult. *E. grandiflorum* flowers very early, and must be given a cool situation and be kept back, to secure any length of stalk. All of the other western species are very satisfactory garden plants. The propagation of *E. Dens-Canis* and varieties, the eastern American species and *E. Hartwegii*, is by offsets. All of the other western species can be increased only by seeds. The eastern species should be planted at least 5 in. deep.

A. *Fls. always solitary, and without a crest near base of inner petals: leaves handsomely mottled: offsets few.*—Old World species.

Dens-Cànis, Linn. The European species: in the type fls. are rosy purple or lilac: stem 4–6 in. high. Variations are white, rose-colored or flesh-colored. Var. **longifòlium**, Hort., varies in its narrower leaves and larger flowers. Var. **Sibíricum**, Hort., from the Altai Mts., is taller.—Little known in Amer. gardens.

AA. *Fl. solitary, without a crest on inner petals: producing offsets.*—Eastern American species.

Americànum, Smith. COMMON ADDER'S TONGUE. Fig. 779. Lvs. mottled: fls. yellow; the segments recurved: bulb with long offshoots. Eastern U. S. and Canada, to Fla. and Ark. Runs into many forms. The following names belong with it: *E. lanceolàtum*, Pursh; *E. angustàtum*, Raf.; *E. bracteàtum*, Boott.

álbidum, Nutt. Lvs. not mottled, narrow: fls. white, yellow at base; segments recurved. Ont. and N. Y. to Tex.

mesachòreum, Knerr. Lvs. not mottled: fls. lavender, the segments not recurved: earlier than the last. Iowa to Kansas.

propúllans, Gray. Lvs. small, green or slightly mottled: fls. rose-colored, with yellow base: offsets produced from the stem sheath. Southern Ontario and Minnesota.

AAA. *Fls. 2–4, sometimes more (rarely only 1-fld.).*—West American species. The lvs. are richly mottled, except in *E. grandiflorum.* The corms do not produce offsets, except in *E. Hartwegii.* Inner petals with auricles except in *E. Howellii.* All except *E. purpurascens* have large and showy fls.

B. *Style 3-cleft.*

grandiflòrum, Pursh (*E. gigantèum*, Lindl.). Lvs. unmottled: stem slender, 1–5-fld.: fls. very bright yellow; petals recurved; anthers yellow.

Var. **álbum**, Hort. (*E. montànum*, Hort.). Like the type, except the fls. are white, yellowish at center, and with a slight greenish cast.

Var. **minor**, Morren, is smaller.

Nuttalliànum, Schult. Like *E. grandiflorum*, and perhaps a variety of it, but has red anthers.

Hártwegii, Wats. Bulb-bearing offsets: lvs. mottled: fls. 1–6, mostly in a sessile umbel, large, light yellow-orange at center. Foothills of the Sierra Nevada mountains in California. G.C. III. 20:361.

revolùtum, Smith. Lvs. 1–4, mottled in white and light brown: fls. nearly always 1 or 2; petals narrow and curved; style large and stout; filaments from subulate (awl-shaped) to deltoid, opening from white flushed with pink to pinkish purple, becoming purple. J.H. III. 35:523.

Var. **Bolánderii**, Hort. (*E. grandiflòrum*, var. *Smìthii*. Hook.). Differing from the type in having white fls., tardily becoming purple, and in being smaller.

Var. **Jóhnsoni**, Purdy (*E. Jóhnsoni*, Bolander). Very similar to the type, but lvs. mottled in dark brown and looking as if coated in varnish, and fls. dark rose with orange center. Gn. 51:1106. G.C. III. 19:549; 25:253.

Var. **præcox**, Purdy. Lvs. mottled in mahogany, the most beautifully in any Erythronium: the fls., usually 2–4, are creamy white with orange center.

Var. **Wátsoni**, Purdy. Differs in having a full, creamy white fl., orange at center, and usually banded with brown above the base; in foggy weather the fl. is bell-shaped: lvs. mottled in brown.—One of the finest of Erythroniums.

Var. **albiflòrum**, Hort. (*E. gigantèum*, var. *albiflòrum*, Hort. *E. grandiflòrum*, var. *albiflòrum*, Hook.). This differs from var. *Watsoni* only in being pure white, with a delicate greenish cast. B.M. 5714. F.S. 20:2117. G.C. III. 3:556; 15:621.

BB. *Style not divided.*

citrinum, Wats. Lvs. mottled: stem 1–3-fld.: petals broad, strongly recurved, light yellow, orange at center, the tips becoming pink.

Héndersonii, Wats. Lvs. mottled in dark brown: petals strongly recurved, pale purple, with a very dark purple, almost black, center. G.F. 1:317. G.C. III. 3:653; 15:623. B.M. 7017.

purpuràscens, Wats. Lvs. not mottled but shaded in dark metallic tints: small, spreading fls. crowded in a raceme, light yellow (almost white), center orange, becoming purplish.—The smallest of our Erythroniums. Properly an alpine.

Hówellii, Wats. Lvs. mottled: scape 1–3-fld.: fls. pale yellow with orange base, becoming pinkish.—Of the Pacific coast Erythroniums, this alone is destitute of the ear-shaped appendages at inner base of petal.

CARL PURDY.

ERYTHRÓXYLUM (Greek, *red wood:* true of some species). *Linàceæ.* COCA. The Cocoa plant, the lvs. of which are of vast importance in medicine, can be grown in the extreme south of Florida and California, and is rarely cult. under glass in the North for its economic interest. It is a shrub 5–6 ft. high, with rusty brown, slender branches, on the extreme tips of which the lvs. are borne. Below the lvs., on the wood of the preceding year, which is reddish, clusters of 3–5 yellow 5-lobed fls. a quarter of an inch across spring from the protection of the small scales that line the branchlets, and which are colored like the bark. The native country of the Coca being still uncertain, it is necessary for purposes of description to take as the type the earliest described form, which happens to be a Peruvian one, named by Lamarck *Erythroxylum Coca*, and figured in the Botanical Magazine 1894, plate 7334. The lvs. of this form are about 2½ in. long, oblong-obovate, tapering to a short stalk, rounded at the apex, the midrib extending beyond into a short, sharp point.

Cocoa is grown commercially on a large scale throughout South America. Peru produces fifteen million pounds of the dried leaf every year, Bolivia half as much, and the rest of South America very much more. The lvs. are chewed to prevent hunger and fatigue. Dr. H. H. Rusby, of New York, in the Therapeutic Gazette, says, "The effects of Cocaine as a nerve stimulus applied to intellectual and emotional activity are ruinous. It takes away appetite, abolishes the sensations of hunger and thirst, lessens waste during exertion, and decreases the exhaustion of ill-fed laborers and travelers. Beyond this, Cocaine has no supporting or nourishing power whatever, and its essential action is enfeebling. Every attempt made to support by it athletic competition has resulted in failure or even disaster." Cocaine is an excellent anæsthetic, and is particularly useful in operations on the eye. Coca should not be confused with Cocoa and Cacao, which are discussed under Theobroma. The literature of Coca, from every point of view down to the year 1889, is reviewed in the Kew bulletin for that year.

W. M.

ESCALLÒNIA (Escallon was a Spanish traveler in S. Amer.). *Saxifragàceæ.* About 40 South American evergreen shrubs or trees, with scattered entire or serrate, ovate or lanceolate lvs, viscid branches, strong-odorous fls. in terminal racemes or panicles: petals 5, linear-spatulate; stamens 5; anthers ovate-oblong; style simple, the stigma capitate and 2–3-lobed: ovary 2–3-loculed. A few species have been introduced in the S., chiefly in S. Calif. They are of easy culture; rapid growers. Some of them will no doubt prove half hardy as far north as Washington. Spring and summer.

Montevidénsis, DC. (*E. floribúnda*, Hort.). Nearly erect bush, branches cylindrical: lvs. 2–4 in. long, elliptic or linear-oblong, obtuse or nearly so, narrowed into a distinct petiole, minutely dentate: fls. white, ½ in. across, in a large, terminal panicle-like cyme. B.M. 6404. B.R. 17:1467.

pulverulénta, Pers. (*E. Berteriàna*, DC.). Shrubs, hairy all over: lvs. elliptic and obtuse, serrate: fls. white, in erect, terminal racemes: branches trigonal.

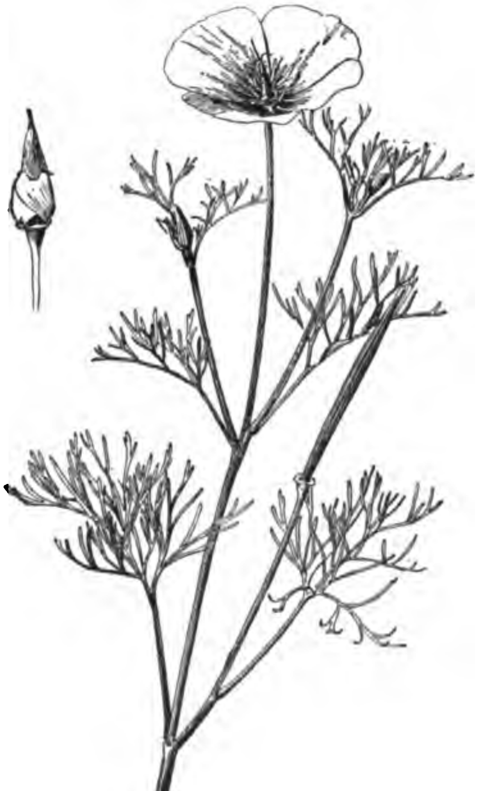
virgàta, Pers. (*E. Philippiàna*, Mast. *E. virgàta*, var. *Philippiàna*, Engl.). Half-hardy shrub south of Washington, with rod-like light brown branches: lvs. nearly sessile, not glandular nor odorous, linear or oblong-spatulate, serrate: fls. white, small, in dense racemes terminating the branchlets.

Organénsis, Gardn. Half hardy S., 2–5 ft., branches red and angled: lvs. elliptic or oblong, crowded, serrate, glossy: fls. pink, in close, terminal clusters. B.M. 4274. —Excellent.

rùbra, Pers. Twiggy shrub, glandular-pubescent: lvs. rather small, obovate-lanceolate, sharp-toothed: fls. long-tubular, red, in short, terminal clusters. B.M. 2890

L. H. B.

ESCHSCHÒLZIA (J. F. Eschscholz, of Kotzebue's scientific expedition). *Papaveràceæ.* About a dozen low, pale or glaucous herbs, annual or perennial, with dissected, alternate lvs., and large, showy yellow or whitish fls.: sepals 2; petals 4; stamens numerous; stigmas 4–6: capsule long and slender like a silique, 1-loculed. The calyx forms a hood which is pushed off over the bud as the petals expand (see detail at the left in Fig. 780). The torus or receptacle (from which the capsule arises) is prominently widened or dilated. Monogr. in Gray, Syn. Fl. N. Amer. 1:90–92. Commonly spelled Eschscholtzia.



780. Eschscholzia Californica (×½).

Califórnica, Cham. CALIFORNIA POPPY. Fig. 780. Perennial, but cult. as an annual, 10–20 in. high, forming mats: lvs. petioled and divided into linear parts:

fl. saucer-shaped, opening in sunshine, 2–3 in. across, yellow or orange or cream-colored: pod 3–4 in. long, strong-ribbed: torus large and funnel-shape. Calif. and Ore., mostly along the coast. B.M. 2887. B.R. 14:1168. R.H. 1894, p. 381.—One of the most popular garden fls. It is treated as a hardy annual. Seeds may be sown very early. It stands considerable cold, and blooms after the first frosts. If well protected, plants of one season's growth will pass the winter and give some bloom the following spring. It sometimes self-sows. Very attractive as an edging, because of its interesting bluish foliage. There are double-fld. forms. Very variable, and cult. under a variety of names, as *C. marítima*, Hort. (not Greene), *C. vària*, Hort. (trade name for mixed varieties), *C. aurantìaca*, Hort., and *C. álba*, Hort. The so-called white varieties are not yet pure white. Do not bear transplanting well.

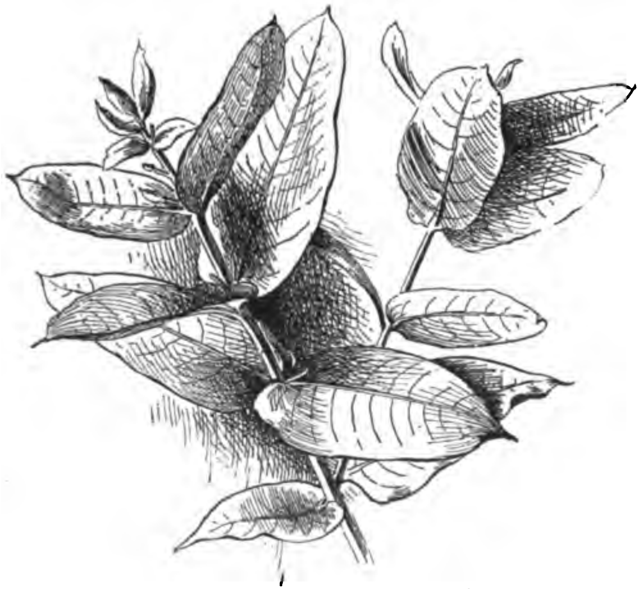
Var. **cròcea**, Hort. (*E. cròcea*, Benth.). Fls. deep orange: torus very widely expanded: calyx bud long-attenuate. B.R. 20:1677. B.M. 3495.

Var. **Doùglasii**, Gray (*E. Doùglasii*, Benth.). Rather more slender, and blooms earlier: fls. pure yellow.

tenuifòlia, Hook. Lower, with finer-cut and denser foliage, the long divisions being almost capillary: fls. small (1 in. across), light yellow, overtopping the lvs.: torus less prominent. Calif. B.M. 4812. L. H. B.

ESTRAGON. *Artemisia Dracunculus.*

EUCALÝPTUS (Greek, *eu*, well; *kalypto*, to cover as with a lid: the calyx limb covering the flower before anthesis, then falling off in the form of a lid or cover). *Myrtàceæ*. GUM TREE. Mostly trees, frequently of immense size; a few of the alpine and sub-alpine species shrubby: lvs. simple, entire (Fig. 781), in the seedlings and young shoots of many species horizontal, opposite, sessile and cordate; in the adult mostly vertical (occasionally horizontal), alternate, petiolate and varying from broadly ovate to lanceolate-acuminate and falcate, thick or thin, always rigid, penniveined, glabrous, except rarely in the young shoots, sometimes covered with a glaucous wax: umbels solitary and axillary or paniculate, near the ends of the branchlets, usually white: fls. in umbels of 3 to many, rarely solitary; calyx tube obconical campanulate or oblong, adnate to the ovary at the base; lobes connate, forming a lid which separates by a circumscissile dehiscence; petals wanting (or adnate to the calyx-lid); stamens numerous, in many rows, usually free, frequently inflexed in bud; anthers small, mostly distinctly longer than broad and opening by parallel longitudinal slits, often almost kidney-shaped and opening by divergent longitudinal slits, or truncate and opening by terminal pores; style undivided: fr. a capsule, opening at the top by 3–6 valves; seeds numerous, mostly angular, only a few fertile. For structure of fruit and calyptra, see Figs. 782–788. A genus of about 140 species, all Australasian, excepting perhaps 5 found in the East Indies. Valuable hardwood trees, mostly of rapid growth: the timber is exceedingly durable and largely used in Australia by shipbuilders, railroad engineers, implement makers, and for building purposes. Felling for timber should be effected towards the end of the dry season, when the flow of the sap is least active. Ring-barking, if necessary, should be performed during the latter part of the cool, or the earlier part of the warm season, so that by largely exhausting the sap, the fewest or no new shoots will rise from the root (Mueller). The leaves of many species contain a valuable antiseptic, volatile oil, which is distilled for pharmaceutical purposes. The bark of several species yields a resin (kino) containing tannin in commercial quantities, on account of which the name of Gum Trees is applied to the genus. *E. globulus* has been very widely distributed over the globe through the persevering efforts of the late Baron Von Mueller; it is frequently planted in the malarial regions of warm climates, as at the Campagna at Rome, with very beneficial effect. (Sanitarians will be interested in "Eucalyptus in Algeria and Tunisia, from an hygienic and climatological point of view," by Dr. Edward Pepper, Proc. Amer. Phil. Soc. 35:39–56.) In England the same species is grown extensively for subtropical gardening, on account of its distinctive glaucous hue and symmetrical growth, but in that climate it needs the protection of glass in winter. But few species are really hardy; most of them, however, can be grown successfully in California and countries enjoying a similar climate.


781. Eucalyptus globulus ($\times\frac{1}{3}$).
Shoots on a young plant.

For ready determination of species in this critical genus, it is necessary to have adult leaves, mature buds, flowers, and mature fruit: immature fruits are often very misleading. Monographed in part by Baron von Mueller in his Eucalyptographia (cited here as F.v.M. Eucal.), in which 100 species are carefully illustrated. Bentham describes 135 species (almost the whole genus) in his Flora Australiensis, Vol. 3. The following key has been adapted from Luehmann's Dichotomous Key, published in 1898: the descriptions have been summarized from the Eucalyptographia, and subsequently verified by reference to herbarium specimens wherever these were available. References to Hook. Icon. mean Hooker's Icones Plantarum.

Culture in the East: Eucalypti are most easily raised from seeds, which generally germinate freely. These should be sown thinly in pots or pans of light, sandy soil, and placed in a little heat. *E. globulus*, when intended to be used for subtropical bedding or for a group on a lawn, is best sown in August and grown on through the winter, for use the following season. In this way much larger and better plants may be obtained than when sowing is deferred to the spring. It is best to raise new plants each year, as lifted specimens do not regain their beauty of the preceding season. Being fast-growing plants, considerable space must be allowed when they become established, either in the open ground or in pots. A rather rich soil, composed of loam and decayed manure, with the addition of some charcoal, to keep it open, is most suitable. *E. maculata*, var. *citriodora*, is very useful for growing in pots in the conservatory, its lemon-scented leaves rendering it a general favorite (Nicholson).

Culture in the South: The process of raising Eucalypts is one of extreme simplicity. Well-ripened seeds, shallowly sown (on open nursery ground, or, should the species be a rare or select one, in wood boxes or seed pans) germinate quickly; when about hand-high the seedlings should be transplanted in the nursery, to check the downward growth of the roots and to promote the formation of lateral rootlets, fit to retain some soil while moving such seedlings to places of permanency. The operation of transplanting should be carried out in the cool season, best under a cloudy sky, and the seedlings ought not to get dried up in any way during the process of removal, regular daily watering for some time afterwards being requisite. Eucalyptus seedlings for shipment to places only a few days' distance may be simply packed in closed cases without much soil; for transmittal to longer distances, they must be well established in pots or bamboo pieces. In this respect Eucalypts should be treated like most pines and other coniferous trees, and, like them, cannot be transplanted when they have attained any size, even when provided with a good ball of earth. But their distribution by means of seeds is the easiest method, on account of the durability and small size of the latter. (F. v. Mueller: adapted).

INDEX.

acmenioides, 31.
albens, 3.
alpina, 35.
amygdalina, 47.
angustifolia, 47.
Baileyana, 42.
buprestium, 15.
calophylla, 5.
citriodora, 1.
coccifera, 44.
***colossea*, 11.**
coriacea, 10.
cornuta, 37.
corymbosa, 4.
corynocalyx, 8.
crebra, 23.
diversicolor, 11.
doratoxylon, 9.
drepanophylla, 22.
ficifolia, 6.
***fissilis*, 18.**
globulus, 34.
gomphocephala, 33.
goniocalyx, 41.
Gunnii, 45.
hæmastoma, 46.
hemiphloia, 3.
Lehmanni, 36.
leptophleba, 22.
leucoxylon, 13.
longifolia, 12, 47.
maculata, 1.
marginata, 25.
megacarpa, 40.
melanophloia, 20.
melliodora, 19.
microcorys, 28.
***obcordata*, 39.**
obliqua, 18.
occidentalis, 38.
pallens, 14.
paniculata, 7.
***pauciflora*, 10.**
pilularis, 30.
piperita, 16.
Planchoniana, 17.
platypus, 39.
polyanthemos, 2.
punctata, 29.
regnans, 47.
resinifera, 26.
Risdoni, 32.
robusta, 24.
rosea, 14.
rostrata, 50.
rudis, 52.
saligna, 27.
siderophloia, 21.
sideroxylon, 14.
***splachnicarpa*, 5.**
Stewartiana, 49.
tereticornis, 51.
***triantha*, 31.**
uncinata, 43.
undulata, 45.
viminalis, 48.

A. ***Fruit-valves quite enclosed in the capsule** (see also No. 25, E. marginata: fruit must be quite mature in order to determine this point).*

B. ***Fls. mostly in terminal or lateral panicles, not simple umbels** (occasionally the inflorescence will appear to be paniculate in section* BB *also, owing to the falling off of the leaves, so that it is necessary to look for the leaf-scars in placing doubtful specimens): lvs. scattered, petiolate (except sometimes in seedlings and robust shoots).*

C. ***Lvs. of equal color on both sides** (see also No. 4 and No. 7, E. corymbosa and E. paniculata).*

D. ***Fruit at least ⅓ in. in diameter, more or less urceolate:** fls. and fruits pedicellate.*

1. **maculàta**, Hook. SPOTTED GUM. Handsome tree, 150 ft. high: bark smooth, whitish or reddish gray, mottled with bluish white or brown reddish spots: lvs. lanceolate; veins feathery-spreading: anthers opening by parallel longitudinal slits; lid double. F.v.M. Eucal. 3:4. Hook. Icon. 619.—Timber valuable for ship-builders, wheelwrights and coopers, and for blocks for street paving.

Var. **citriodòra**, Bailey (*E. citriodòra*, Hook.). LEMON-SCENTED GUM. Handsome tree: trunk slender: bark smooth, white: branchlets long, slender and drooping: lvs. very long and narrow, light green, strongly lemon-scented: fls. creamy white. May–July.—A favorite ornamental tree, of rapid growth in the warmer parts of California: subject to frost. Timber valuable for piles and girders: volatile oil used in perfumery: the young plants useful for window or cool greenhouse culture.

DD. ***Fruit rarely exceeding ¼ in. in diameter.***

2. **polyánthemos**, Schau. RED BOX-TREE. Well branched tree, from 40 ft. or less to 150 ft. high: bark brown or ash-gray, persistent, roughish: lvs. from orbicular to ovate, dull and grayish green on both sides: lid depressed- or pyramidal-hemispherical and faintly pointed: fls. small, white, in close panicles, described as resembling gigantic heads of mignonette; outer stamens sterile; fertile anthers truncated, opening by terminal pores. F.v.M. Eucal. 3:9. Hook. Icon. 879.—Fairly rapid grower. Timber extremely hard and durable, unsurpassed for fuel, and much used in Australia for ties and wheelwrights' work. Very useful for bees, flowering in Jan. and Feb.

3. **hemiphlòia**, F. v. M. AUSTRALIAN BOX-TREE. Tree, 90 ft. or less high: bark of trunk persistent, solid, grayish and somewhat wrinkled; of branches deciduous, in flakes or long strips: lvs. from lanceolate-falcate to ovate-lanceolate, thick and rigid, often ashy gray; lateral veins diverging at a very acute angle: lid conical: anthers very minute, globular, opening by lateral, pore-like apertures. F. v. M. Eucal. 5:5.—Timber hard and tough, valued in Australia for railroad ties, telegraph poles, shafts, spokes, etc.; also makes excellent fuel.

Var. **álbens**, Moore (*E. álbens*, Miq.). WHITE BOX-TREE. Bark dull green, persistent: lvs. glaucous or mealy white: fls. chalk-white.

CC. *Lvs. paler beneath than above: branchlets glabrous.*

D. *Fruit urceolate (urn-shaped) over ⅓ in. long: lid of calyx not broader than the tube, tearing off along an irregular suture: anthers distinctly longer than broad, opening by almost parallel longitudinal slits.*

E. *Size of fruit under 1 in. in diameter.*

4. **corymbòsa**, Smith. BLOODWOOD. Small tree: outer bark persistent, rough-furrowed, gray and turning somewhat black; inner yellowish or reddish brown; that of the upper branches smooth and often reddish: lvs. lanceolate, only slightly curved, firm; midrib very prominent, lateral veins very numerous, fine, almost transversely spreading; oil-dots inconspicuous: peduncles and pedicels long, slender: fls. yellowish white, fragrant: lid depressed-hemispherical, short-pointed: fr. large, oval-urn-shaped. Aug.–Decem. F.v.M.Eucal. 5:2.—Timber very hard when dry, durable under ground, and much used in Australia for fence posts, rails, railroad ties, and rough building purposes: bark yields about 28 per cent tannic acid; dried lvs. about 18 per cent.

EE. *Size of fruit exceeding 1 in. in diameter: lvs. turning the surface more than the edge, to the zenith; veins feathery-spreading.*

5. **calophýlla**, R. Br. Medium-sized, umbrageous tree: bark persistent, dark, deeply furrowed: lvs. broad- or lanceolate-ovate, firm and thick, conspicuously stalked: fls. large, white, rarely pink, in large clusters: lid thin, patellar: fr. large, smooth, ovate-urn-shaped, border compressed; seeds very large, black, not winged. July–Oct. B.M. 4036 (as *E. splachnicarpa*). F. v. M. Eucal. 10:2. G.C. III. 20:661.—Ornamental tree, but of rather slow growth and subject to frost. Fruits polished and sold for pipe bowls: good shade-tree for avenues: valuable for bees, flowering late into the fall: bark contains tannin.

6. **ficifòlia**, F.v.M. CRIMSON-FLOWERED EUCALYPTUS. Figs. 782, 783. Handsome, umbrageous dwarf tree or tall shrub, of symmetrical habit: bark persistent, furrowed: lvs. broad- or ovate-lanceolate, rigid, conspicuously stalked; veins almost transverse: fls. crimson or scarlet: fruits large, smooth, urn shaped-ovate; border compressed; seeds pale brown, broadly winged. Aug., Sept. F.v.M. Eucal. 7:3.—Very ornamental; adapted to the lemon-belt: a shady, heat-resisting avenue tree, withstanding drought. Fruits polished for pipe bowls.

782. Fruit and bud of E. ficifolia. (×⅓.)

DD. ***Fruit truncate-ovate, pedicellate.***

7. **paniculàta**, Smith. RED IRONBARK. Medium-sized tree: bark persistent, hard, rough: lvs. rather thin: fls. sometimes borne in axillary umbels: lid thin, conical, semiovate; outer stamens sterile; anthers minute, truncate, opening by minute pores at the summit; stigma dilated, distinctly broader than the summit of the style: calyx-tube and fr. sometimes 4-ribbed. May. F. v. M. Eucal. 5:8.—Timber hard and durable, lasting under ground; valuable for railroad ties, fencing and building purposes.

BB. *Fls. in simple, axillary umbels: fr. with 3 or more cells, and not exceeding 1 in. in length. (See also E. paniculata, No. 7.)*

C. *Lid projecting beyond the rim of the calyx tube: anthers distinctly longer than broad, opening by almost parallel longitudinal slits.*

8. **corynocàlyx**, F. v. M. Sugar Gum. Tree, 120 ft. high: bark smooth: lvs. elongate-lanceolate, slightly curved, somewhat paler beneath: lid almost hemispherical: fr. urn-shaped-ellipsoid, longitudinally streaked. June–Sept. F. v. M. Eucal. 2:2.—The best drought-resisting tree for desert regions (Mueller); the foliage contains but little oil, is sweetish, and is browsed by stock. Needs protection from sea breeze when planted along the coast. An ornamental tree used for roadside planting in southern California. Timber hard, strong, durable; useful for railroad ties and fence posts. Said to be the quickest-growing shade tree for regions exposed to hot, bleak winds; will stand 18° F.

783. Eucalyptus ficifolia (×⅓).

CC. *Lid not projecting beyond the rim of the calyx-tube.*

D. *Lvs. opposite: anthers minute, not longer than broad (nearly oval), opening by longitudinal slits.*

9. **doratóxylon**, F. v. M. Spear-wood. A pretty, small tree or tall shrub: bark smooth, greenish white: lvs. stalked, narrow, lanceolate: umbels bent downward, on recurved, slender, compressed peduncles: lid terminating in a beak-like point: outer filaments sterile. F. v. M. Eucal. 4:4.—Graceful tree, of slender habit: timber firm and elastic.

DD. *Lvs. scattered.*

E. *Leaf-veins several, longitudinal, almost parallel with the midrib.*

10. **coriàcea**, Cunn. (*E. pauciflòra*, Sieb.). White Gum. Handsome tree: branches spreading; branchlets slender and more or less drooping: bark smooth, whitish gray: lvs. broad, elongated, thick: lid hemispherical, twice or thrice shorter than the tube, usually quite blunt: anthers almost kidney-shaped, opening by very divergent, longitudinal slits: fr. shortly-pedicelled. Nov.–Feb. F. v. M. Eucal. 3:6.—An alpine tree, and one of the hardiest species. Cattle browse on the foliage in seasons of drought. Timber used for fuel, fences and building purposes; sometimes badly affected with scale.

EE. *Leaf-veins all more or less diverging from the midrib.*

F. *Foliage much paler beneath (see also No. 25, E marginata): anthers almost heart-shaped, opening by longitudinal slits.*

11. **diversicolor**, F. v. M. (*E. colóssea*, F. v. M. *E. diversicolor*, var. *colossea*, Hort.). Karri. Very tall, symmetrical tree, attaining 12 ft. in diameter: bark smooth, white: lvs. scarcely inequilateral, dark green and shining above; veins feathery-spreading, fine: lid nearly hemispherical: fls. white, in heavy clusters; stamens all fertile. March–May, and again in Novem. F. v. M. Eucal. 5:4.—A rapid grower, profuse bloomer, and considered a good tree for bees. Timber elastic, valued for building purposes, shafts, masts and fence rails.

FF. *Foliage of equal color on both sides, or nearly so.*

G. *Pedicels elongated: lid conical.*

12. **longifòlia**, Link. Woollybutt. Tall tree: bark persistent, gray, rough or wrinkled, somewhat fibrous: lvs. elongated; veins very spreading: lid broadly conical, acute, pale: stamens all fertile; anthers cuneate- or oblong-oval, opening by longitudinal slits: stigma not dilated: fr. rather large, bell-shaped, semiovate, angular: margin outwardly ascending. F. v. M. Eucal. 2:4.—Flowering almost continuously. Valuable for bees.

13. **leucóxylon**, F. v. M. White Ironbark. Tall tree. usually branching below: bark mostly deciduous, smooth, pale: lvs. narrow-lanceolate, grayish or dull green: fls. usually in 3's, white or rarely pink: lid semiovate, pointed: outer stamens sterile; anthers truncated, opening by apical pores; stigma much dilated: fr. slightly contracted at the orifice, rarely slightly angular. Jan.–Apr. F. v. M. Eucal. 1:4.—Valuable bee tree, making an excellent honey. Timber superior to that of almost any other Eucalypt for certain purposes. Valued for hardness and durability; used by wagon- and ship-builders, also for railroad ties and underground work, for axe handles and for turning. Will grow on stony ridges not adapted to ordinary cultural purposes.

14. **sideróxylon**, Cunn. (*E. leucóxylon*, var. *sideróxylon*, Authors). Red Ironbark. Perhaps not specifically distinct from *E. leucoxylon:* usually not branched below: bark persistent, rough, dark red: lvs. green: fls. white or yellowish.

Var. **ròsea**, Hort. (*E. leucórylon*, var. *ròsea*, Hort.). Lvs. green: fls. rose-colored. March, Apr.—A handsome form and profuse bloomer.

Var. **pállens**, Auct. (*E. leucóxylon*, var. *pállens*, Benth. *E. leucóxylon*, var. *pállida*, Hort. *E. sideróxylon*, var. *pállida*, Hort.). Lvs. silvery gray: fls. red.—A profuse bloomer.

GG. *Pedicels short or none: fertile seeds not winged.*

H. *Fr. much contracted at the orifice, nearly globular: outer anthers kidney-shaped, opening by divergent slits.*

15. **bupréstium**, F. v. M. Shrub, 10 ft. high: lvs. about 2 in. long, narrow; oil-dots much concealed: fls. small, almost pear-shaped in bud: lid hemispherical, pointed: inner anthers opening by large, roundish pores: fr. nearly 1 in. in diam., truncate-globular. grayish; margin compressed. July, Aug. F. v. M. Eucal. 6:1.—Valuable for bees.

16. **piperita**, Smith. Peppermint Stringy-bark. Tall tree: bark persistent, gray, rough and fibrous: oil-dots copious, transparent: lid broad-conical, acute: fr. about ¼ in. in diam. F. v. M. Eucal. 3:8.

HH. *Fr. but slightly or not at all contracted.*

I. *Diameter of fr. nearly 1 inch.*

17. **Planchoniàna**, F. v. M. Tree, 100 ft. high: peduncles erect, broadly compressed: pedicels very short or almost none: lid narrow-conical, from a semi-ovate base, about as long as the calyx-tube, both longitudinally streaked: anthers ovate or roundish ovate, opening by longitudinal slits. July. F. v. M. Eucal. 4:6.—A profuse bloomer. Timber heavy, hard and durable: well adapted for sawing, but not easy to split.

II. *Diameter of fr. rarely exceeding ½ in.*

J. *Calyx-tube and lid granular, rough.*

18. **obliqua**, L'Her. (*E. fissilis*, F. v. M.). Stringy-bark. Tall tree: bark persistent, grayish, very fibrous. but rather soft and fragile: lvs. very inequilateral at base: peduncles nearly terete, mostly slender: calyx tube terete: lid hemispherical, depressed or scarcely pointed. March–May. F. v. M. Eucal. 3:5.—Much valued in Australia for bees. Will grow on poor, dry soil, but subject to frost in California. Wood useful only for cheap, rough work.

JJ. *Calyx-tube and lid smooth.*

19. **melliodòra,** Cunn. Honey-scented Gum. Spreading tree, 120 ft. high: bark more or less persistent below, roughish, brownish gray without, yellowish within: fls. small: lid conic-hemispherical: outer stamens sterile; anthers minute, truncated, opening by terminal pores: fr. truncate-globular, not exceeding ½ in. in diam., mostly 4-celled. Feb.–Apr.—F.v.M. Eucal. 2:5.—Timber used by wheelwrights and ship-builders; makes excellent fuel: fls. particularly rich in nectar, and much sought by bees.

AA. *Fruit-valves either quite exserted or the points reaching the level of the rim. (Fruit must be fully mature in order to render this point determinable.)*

B. *Fls. generally panicled: anthers renate-cordate, opening by longitudinal slits: lvs. of equal color on both sides.*

C. *Lvs. opposite, more or less ovate.*

20. **melanophlòia,** F. v. M. Silver-leaved Ironbark. Small tree: bark persistent, deeply furrowed, blackish: lvs. glaucous or mealy white, sessile, from cordate-ovate or orbicular to ovate-lanceolate, obtuse or acute: peduncles 3- to 8-flowered: anthers very small and globular; cells parallel and distinct: fr. truncate-globular, 2 or 3 lines long.

CC. *Lvs. scattered, lanceolate.*

21. **siderophlòia,** Benth. Large-leaved Ironbark. Tree, 150 ft. high: bark wholly persistent, deeply and somewhat anastomosingly furrowed; furrows yellowish or dark brown: lvs. elongated: lid conical, very acute, about 3 lines long: outer filaments straight in bud; anthers very minute, roundish; stigma not dilated. October. F. v. M. Eucal. 4:8.—Timber very strong, hard and durable; used for railroad ties, wharf piles, spokes and tool-handles.

22. **drepanophýlla,** F. v. M. Low, stunted tree: bark ribbed, dark gray: lvs. thin, often over 6 in. long; veins fine, numerous, parallel and very diverging: umbels 3- to 6-flowered: fls. large; calyx-lid about as long as the tube (not exceeding 2 lines long): fr. 3 to 4 lines in diameter; valves level with or hardly projecting beyond the rim. Said to be near *E. crebra*, differing mainly in the large flowers and in the larger, harder and more globular fruit.

Var. **leptophlèba,** Luehm. (*E. leptophlèba*, F. v. M.), is said to be chiefly distinguished by the lvs. being thicker and the veins more oblique. Timber strong, hard and very durable; used for bridges, mine props and fence posts.

23. **crèbra,** F. v. M. Narrow-leaved Ironbark. Tall tree: bark persistent throughout, dark, almost blackish, ridged and deeply furrowed, solid: lvs. narrow, linear-lanceolate, thin: lid semiovate-conical, not exceeding 2 lines long: filaments inflexed in bud; stigma dilated: fruit-valves level with or hardly projecting beyond the rim, not exceeding 2 lines in diameter. F. v. M. Eucal. 5:3.—Timber heavy, hard, elastic and durable; used for railroad ties, piles, fence posts, and in the construction of bridges and wagons; also suitable for splitting into palings.

BB. *Fls. mostly in simple axillary umbels: fruits not exceeding 1 in. in diam.*

C. *Lvs. paler beneath.*

D. *Calyptra lid broader than the calyx-tube.*

24. **robústa,** Smith. Swamp-mahogany Gum. Fig. 784. Handsome, symmetrically branching tree, 100 ft. high: bark of trunk persistent, rough, dark brown; of the branches reddish: lvs. large, oval-lanceolate, long-pointed, dark green, coriaceous; the veins almost horizontally spreading: peduncles broadly flattened: fls. large, creamy white; calyx pale; lid hemispherical below, cylindric-conical pointed above; anthers oblong-oval, opening by parallel longitudinal slits. Fine avenue tree; profuse bloomer, especially valuable for bees. Dec.–Feb. F.v.M. Eucal. 7:8.—Timber remarkably durable; used for ship-building, wheelwrights' work, mallets, etc.: seems to thrive well in low, sour, swampy ground near the seacoast.

784. Fruit and buds of E. robusta (×½).

DD. *Calyptra lid not broader than the calyx-tube.*

E. *Fruit ½ in. or more in diameter.*

25. **marginàta,** Smith. Jarrah. Tall tree: bark persistent, somewhat fibrous: leaf-veins spreading: lid conical: stamens all fertile, the outer not inflexed in the bud; anthers cordate-kidney-shaped, opening by divergent longitudinal slits: fr.-valves very short, scarcely or not at all exserted. Apl., May. F. v. M. Eucal. 7:5.—Valuable hardwood tree, requiring a warm climate: timber not attacked by teredo; used for wharf piles, underground work, telegraph poles, railroad ties, floorings, rafters, shingles and furniture; it is easily worked, makes a fine finish, takes a good polish; used in England for street paving.

EE. *Fruit under ½ in. in diameter.*

F. *Length of lid usually twice or thrice that of the calyx tube.*

26. **resinífera,** Smith. Kino Eucalypt. Tall tree: bark of trunk persistent, rough, of branches deciduous: leaf-veins pinnately spreading: oil-dots pellucid, more or less obliterated: lid conical: stamens all fertile, inflexed in the bud; anthers longer than broad, opening by parallel longitudinal slits. F. v. M. Eucal. 1:9.—Timber valued for its strength and durability; particularly good for fuel; used in Sydney for street paving.

FF. *Length of lid shorter than or equaling that of the calyx-tube.*

G. *Foliage much paler beneath: lateral veins numerous, very spreading.*

27. **salígna,** Smith. Tall tree: bark gray and smooth: leaf-veins feathery-spreading: oil-dots numerous but much concealed: peduncles broadly compressed; pedicels very short or none: lid hemispherical, short pointed: stamens all fertile; anthers longer than broad, opening by parallel longitudinal slits. Nov. F. v. M. Eucal. 2:8.—Said to be hardier than *E. globulus*; prefers rich, alluvial soil.

28. **microcórys,** F.v.M. Tallow-wood Gum. Tall tree: bark persistent throughout, wrinkled: lvs. thin, of almost papery consistence, copiously dotted with pellucid oil-glands, paler and opaque beneath; veins spreading: pedicels elongated; club-shaped, almost continuous with the calyx tube: lid depressed-hemispherical, hardly jointed: anthers very minute, almost heart-shaped, opening by divergent slits. F.v.M. Eucal. 2:6.—Timber hard, durable, easily worked; used preferably for wood bricks; also for railroad ties, knees and breast-hooks in ship-building, and telegraph poles.

GG. *Foliage slightly paler beneath, the lateral veins not very close and moderately spreading.*

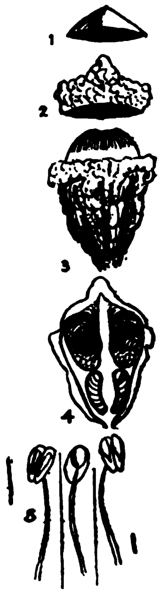
H. *Fruit broadest at the orifice: fertile seeds much larger than the sterile ones: stamens all fertile: anthers longer than broad, opening by parallel longitudinal slits.*

29. **punctàta,** DC. Leather-jacket. Hickory Gum. Beautiful spreading tree, 100 ft. or more high: bark smooth and dark, thick, most of the outer deciduous: lvs. thin; veins divergently spreading: peduncles broad, strongly compressed: pedicels angular, thick: lid bluntly conical. F.v.M. Eucal. 6:7.—Timber hard, tough and very durable, suitable for fence posts, railroad ties, wheelwrights' and ship-builders' work.

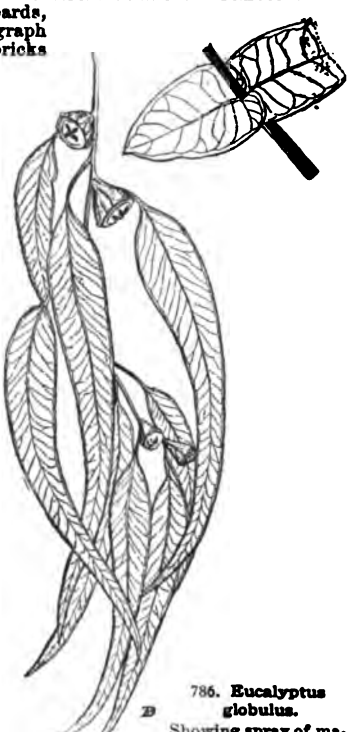
HH. *Fruit contracted at the orifice: fertile seeds not much larger than the sterile ones: stamens all fertile: anthers kidney-shaped, opening by divergent longitudinal slits.*

30. **pilulàris,** Smith. Blackbutt. Tree, 300 ft. or less high: bark of trunk persistent, blackish gray outside, somewhat fibrous and brownish inside; of branches smooth, gray or whitish: lvs. rather less shining below than above: peduncles strongly compressed: lid attenu-

ate, from a broadly conical base: fr. about 4 lines in diameter; rim thick. F.v.M. Eucal. 3:7.—Timber suitable for floor boards, railroad ties, telegraph poles, and wood bricks for street paving.



785. Eucalyptus globulus.



786. Eucalyptus globulus. Showing spray of mature foliage (×⅙) and two leaves of sucker foliage.

31. **acmenioides**, Schau. (*E. tridntha*, Linn. *E. pilulàris*, var. *acmenioides*, Benth.). White Mahogany Gum. Tall tree: bark of trunk persistent below, fibrous: peduncles not much compressed, slender: lid hemispherical, pointed at the summit: fruit not exceeding 3 lines in diameter; rim thin. F.v.M. Eucal. 10:1.—Timber heavy, strong and durable; good for palings, rails, floor boards, etc.

cc. *Lvs. of equal color on both sides.*

D. *Mostly opposite lvs., not connate (except sometimes in No. 32, E. Risdoni); margin entire: fruit rarely exceeding ½ in. in diameter, truncate-ovate.*

32. **Risdoni**, Hook. Drooping Gum. Small or medium sized tree: bark deciduous, smooth: branches usually pendulous, bark brown or ashy white: lvs. acute, ovate: lid hemispherical, obtuse: anthers kidney-shaped, opening by divergent longitudinal slits. Closely related to *E. amygdalina.*

DD. *Mostly scattered lvs.: fls. and fruits sessile or on short pedicels.*

E. *Lid much broader than the calyx-tube.*

33. **gomphocéphala**, DC. Tooart Tree. Tree, 120 ft. or less high: bark persistent, rough but not stringy, rather dark on old trunks, smooth and grayish on younger trees and branches: lvs. thick, narrowly acuminate, pale green: peduncles broadly flattened; pedicels wanting: lid almost hemispherical: fr. large, top-shaped; border broad, convex. Nov. F.v.M. Eucal. 7:4.—A very distinct species, easily distinguishable by the broad lid. Timber tough, heavy and rigid, texture close, grain twisted, shrinks but little and does not split while seasoning; suitable for large scantlings where great strength is needed, also in ship-building and for bridge supports. One of the strongest woods known.

EE. *Lid not or only slightly broader than the calyx-tube.*

F. *Calyx-tube and lid warty; anthers larger than broad, opening by nearly parallel longitudinal slits.*

34. **glóbulus**, Labill. Blue Gum. Figs. 781, 785, 786. Tree, 300 ft. or less high: bark grayish or bluish white, smooth except at the base of the trunk: lvs. lanceolate, thick: calyx-tube and lid covered with bluish white wax: fr. large, angular. Dec.–Feb. F.v.M. Eucal. 6:2. G.C. II. 15:601; III. 2:784; 10:737.—Very attractive to bees, but the nectar has a strong and unpleasant odor. In California more extensively planted than any other Gum, and readily spreading by voluntary seedlings. Will stand protracted drought without irrigation in a region of only 8 or 10 inches annual rainfall (Franceschi). The most rapid-growing species. Timber used in Australia by ship-builders for planking and keels; also for fence rails, telegraph poles, railroad ties, shafts and spokes. It has been recommended for wine casks. Will tolerate 19° F. Fig. 785 shows the stamens (5) and the structure of the bud. Nos. 1–4 are ½ nat. size; 5 is on a larger scale. No. 4 is a section of a bud.

35. **alpina**, Lindl. Shrub, 12 ft. high: lvs. inequilaterally half-ovate, blunt, acute on young shoots, leathery: fls. sessile in the leaf axils, solitary or few: fr. large, 8 lines wide, almost hemispherical, not angular. Sept.–Nov. F.v.M. Eucal. 2:1.—A very rare and interesting alpine species, possibly suitable for street planting.

FF. *Calyx-tube and lid smooth or rough, but not warty: lvs. much exceeding 1 in. in length.*

G. *Stamens not inflexed in the bud (see also No. 51, E. tereticornis): peduncles broadly flattened: calyx lid long, cylindrical, obtuse: anthers ellipsoid, opening by parallel longitudinal slits.*

36. **Léhmanni**, Preiss. Tall shrub or small tree: bark coming off in irregular sheets, roughish and reddish: fls. greenish yellow; calyx lid often 1½ in. long: ovary convex at the top: fr. half immersed in the receptacle, about ½ in. in diameter; valves connivent into a cone, tapering into the persistent base of the style. July–Sept.—Valuable ornamental tree.

37. **cornùta**, Labill. Yate Tree. Large tree: calyx lid 1–1¼ in. long: filaments yellow: ovary almost on a level with the calyx rim, the top flat or at length slightly convex; style thickened at the base: fr. free (not immersed in the receptacle). July–Sept. F.v.M. Eucal. 9:1.—Closely related to the preceding. Used successfully as a roadside tree in southern California; adapted to the lemon belt, and tolerating alkaline and saline soils (Franceschi). Prefers a somewhat humid soil. Timber hard, tough and elastic, suitable for shafts and frames of carts, and considered equal to ordinary ash wood. B.M. 6140.

787. Fruits and buds of E. occidentalis (×⅓).

38. **occidentàlis**, Endlich. Flat-topped Yate. Fig. 787. Tall tree: bark deciduous, mostly smooth: lvs. narrow-lanceolate: calyx lid ⅓–¾ in. long; filaments yellowish: fruit-valves only half exserted, awl-shaped, free. F.v.M. Eucal. 6:5.—Individuals show great diversity in time of flowering, so that specimens may be found in blossom at any time between August and April.

39. **plátypus**, Hook. (*E. obcordàta*, Turcz.). Tall shrub, 30 ft. or less high: bark smooth, grayish: lvs. petiolate, leathery, broad-obovate, blunt, shining: peduncles flattened and winged, bent downwards: fls. sessile, dull red or yellowish white, not conspicuous: calyx-tube prominently angular, much broader than the conic-cylindrical lid: fr. truncate-ovate, very angular, border compressed; flowering almost continuously, but never much at a time. F.v.M. Eucal. 7:6. Hook. Icon. 849.

GG. *Stamens inflexed in the bud: fruits from ½ to 1 in. in diameter.*

40. **megacárpa**, F.v.M. Tree, 100 ft. or less high: bark deciduous, smooth, grayish white: peduncles sharply 2-edged and dilated upwards: fls. 1–2 or 3, ses-

sile; anthers with a large dorsal gland near the apex: fr. large, slightly angular-streaked; valves thick, convergent, emersed; border broad, depressed. F.v.M. Eucal. 6:3.

GGG. *Stamens inflexed in the buds: fruits mostly under ½ in. in diameter: lvs. lanceolate, rarely linear: calyx-tube and lid not ribbed.*

H. *Calyx-tube angular: pedicels flattened.*

41. **goniocàlyx**, F. v. M. Bastard Box Tree. Tall tree: peduncles compressed: pedicels very short and angular or wanting; calyx-tube conspicuously angular: lid pyramidal-hemispheric: fr. angular: valves deltoid, almost enclosed. August. F. v. M. Eucal. 1:3.—Ascends to 4,000 ft. elevation. Timber especially esteemed for wheelwrights' work; also used for house-building, fence rails, etc.; excellent for fuel.

HH. *Calyx-tube and pedicels terete: fr.-valves short, often deltoid.*

I. *Capsule inserted below the rim of the calyx-tube, or on a level with it.*

J. *Frs. urceolate (i.e., urn-shaped).*

42. **Baileyàna**, F. v. M. Tall tree: bark persistent throughout, fibrous: foliage dense and shady: lvs. much dotted: anthers broadly cordate, opening by divergent slits: fr. rather large, globular-urn-shaped, 3-celled; valves deltoid, slightly exserted. F. v. M. Eucal. 3:1.—Will grow well on sandy soil. Timber splits easily, is tough and durable; used for fence posts, etc.

JJ. *Frs. mostly ovate-truncate, never urceolate: pedicels short; calyx-lid hemispherical, mostly blunt and shorter than the tube.*

K. *Leaf-veins fine, numerous, very divergent.*

43. **uncinàta**, Turcz. Shrub, branching from near the base with several thin stems: bark deciduous, smooth and grayish or reddish: lvs. firm, very light green, narrow: fls. small; stamens remaining bent inward in anthesis; anthers very minute, almost globular, opening by terminal pores: fr. very small. F. v. M. Eucal. 4:10.—A very hardy species.

KK. *Leaf-veins not numerous, very oblique.*

44. **coccifera**, Hook. Small, glaucous tree: lvs. thick and shining. under 3 in. long: peduncles short, thick and much flattened upwards: calyx-tube narrow-turbinate, tapering at the base, prominently angled: lid short, broad, flat or depressed, rugose: anthers kidney-shaped, opening by divergent, longitudinal slits: fr. almost flat on the top. Tasmania, 3,000–4,000 ft. elevation. B.M. 4637. G.C. II. 12:113; 13:395; III. 2:787, 789; 3:799, 801; 9:169.—Perhaps only a sub-alpine form of *E. amygdalina*.

45. **Gúnnii**, Hook. Cider Gum. Small, often scrubby tree: lvs. thick, shining, less than 3 in. long: calyx-lid shining, hemispherical, short-pointed: anthers almost oval, opening by parallel longitudinal slits: capsule somewhat sunk below the narrow rim of the calyx-tube. A very hardy species. Cattle and sheep readily browse on the foliage, as it lacks the peculiarly pungent Eucalyptus odor. May, June. G.C. II. 19:437; III. 2:781; 11:787.

Var. **undulàta**, (*E. Gúnnii*, F. v. M. Eucal. 4:5., not of Hook. *E. undulàta*, Luehm., not of F. v. M.). Swamp Gum. Tall tree: lvs. longer (over 3 in.), broad and somewhat undulate: fr. top-shaped.—Yields a great deal of nectar, and flowers earlier than *E. viminalis*. Timber strong and useful.

JJJ. *Frs. ovate or globose, truncate: rim rather broad and flat; anthers broader than long almost kidney-shaped, opening by divergent longitudinal slits: lvs. green: bark of trunk smooth or fibrous.*

46. **hæmastòma**, Smith. White Gum. Tree: lvs. broad; veins spreading, prominent: outer stamens sterile: fr. short, ovate-truncate, with a reddish apex. F. v. M. Eucal. 2:3.—Will grow on poor, sandy land. Timber of inferior quality.

47. **amygdalina**, Labill. Peppermint Gum. Tall tree: bark persistent on trunk and lower branches, fibrous: lvs. rather small, narrow-lanceolate, attenuate into the petiole; veins not much spreading; oil-dots large and not very numerous, translucent: fr. globose, truncate or shortly ovate. F. v. M. Eucal. 5:1. B.M. 3260. B.R. 11:947 (as *E. longifolia*). G.C. III. 6:16.—Timber not strong, but suitable for shingles, rails, staves, inner building material, etc. Foliage yields more volatile oil than that of any other species tested.

Var. **régnans**, F. v. M. Giant Gum. Very tall tree, (415 ft. or less high): bark usually smooth, whitish, fibrous only near the base: lvs. large, broad-lanceolate; oil dots very fine, numerous.

Var. **angustifòlia**, F. v. M. Graceful, spreading tree: branchlets drooping: lvs. very narrow: fls. very numerous in the umbel. Jan.–Apl., and more or less throughout the year.

II. *Capsule raised above the rim of the calyx-tube: lvs. mostly large, inequilateral; veins very diverging: stems of young plants nearly terete: anthers longer than broad, opening by parallel longitudinal slits.*

J. *Flowers mostly three in an umbel.*

48. **viminàlis**, Labill. Manna Gum. Fig. 788. Tall and graceful. spreading tree, 300 ft. or less high: bark persistent, roughish and dark-colored (never fibrous), or deciduous, very smooth and grayish white: seedling leaves lanceolate: pedicels almost none or very short: lid semi-ovate, mostly short-pointed. F. v. M. Eucal. 10:10. G.C. III. 4:597.—A hardy species, withstanding considerable frost and strong winds. Timber not as strong as that of many other species, but frequently employed for shingles, fence rails and ordinary building purposes. Sheep will feed on the foliage. A valuable bee tree. Growing readily in California from voluntary seedlings. Seed said to retain its vitality ten years.

788. Fruits and buds of E. viminalis (X½).

JJ. *Flowers more than three in an umbel.*

49. **Stuartiàna**, F. v. M. Apple-scented Gum. Tall, branching tree, with dense, drooping foliage; closely related to *E. viminalis*, and distinguishable from the latter when it has more than 3 flowers in an umbel, by the fibrous bark and roundish seedling leaves: pedicels almost none: calyx-lid almost hemispherical or shortly and bluntly conical. March–May. F.v.M. Eucal. 4:9.—One of the hardiest species: timber used mostly for fencing and fuel.

50. **rostràta**, Schlecht. Red Gum. Tree, 200 ft. or less high: bark early deciduous, smooth, ashy gray or whitish: pedicels conspicuous: calyx-lid acuminate, usually ending in a beak (occasionally blunt). Apl., May. F. v. M. Eucal. 4:7.—Useful for bees. Prefers a moist soil with a clayey subsoil; thrives in ground periodically inundated for a considerable time, and even in slightly saline places: stands 22° F. in Italy. Timber hard, heavy, strong and extremely durable, either above or under ground or in water; suitable for fence posts, piles and railroad ties; also extensively used in shipbuilding and for wood bricks for street paving; said to make a better fuel than wood of *E. globulus*. Somewhat hardier than *E. globulus*.

51. **tereticórnis**, Smith. Flooded Gum. Tall tree: bark smooth: peduncles elongated: pedicels conspicuous: calyx-lid conical, not beaked, often much elongated: fr. almost globose through the broad, ascending rim. Apr., May. F. v. M. Eucal. 9:8.—Closely related to *E. rostrata*. Will thrive on undrained ground. Timber used by wheelwrights.

52. **rùdis**, Endl. Tree, 80 ft. high, or less: bark persistent, rough: peduncles ⅓–1 in. long: pedicels short: calyx-lid conical, not beaked; commissural line between calyx tube and lid prominent: rim of fr. only slightly ascending. Sep.–Nov. F. v. M. Eucal. 10:8.—Stands drought better than many others, and promises

to make a beautiful avenue tree; young growth of a deep copper color; adapted to the lemon belt (Franceschi).

E. botryoìdes, Smith. Placed next after E. robusta in the key. Tall tree: lid not broader than the angular calyx tube. F. v. M. Eucal. 4:2. Timber valuable.—*E. citriodòra*, Hook.= maculata, var. citriodora.—*E. decìpiens*, Endlich. Placed next after E. goniocalyx in the key. Tree, 70 ft. high: calyx tube and pedicels terete: capsule raised above the rim of the calyx tube: fr.-valves ending in 5 points. F. v. M. Eucal. 10:3.—*E. eugenioìdes*, Sieb. WHITE STRINGY-BARK. Placed second after E. Gunnii, var. undulata, in the key. Tree, 200 ft. high: fls. more than 3 in an umbel: fr. ovate or globose, truncate: rim narrow, the valves inserted somewhat below it. March–Sept. F. v. M. Eucal. 10:4. Timber valuable.—*E. exímia*, Schauer. MOUNTAIN BLOODWOOD. Placed next before E. maculata in the key. Tree, about 80 ft. high: fls. cream-colored, sessile, in Oct. frs. sessile. F. v. M Eucal. 9:2. Wood makes good fuel. Handsome tree when in blossom.—*E. incrassàta*, Labill. MALLEE. Placed after E. Planchoniana in the key. Shrub or small tree: frs. rarely exceeding ½in. in diam.: peduncles erect, short and thick, usually much flattened. F.v.M. Eucal. 5:6. "Will live in mere sand and brave the most scorching hot winds, but will bear some frost. The lvs. supply a considerable proportion of the mercantile Eucalyptus oil."—*E. macrorhýncha*, F. v. M. Placed before E. viminalis in the key. Leaf-veins very oblique: fls. and frs. on short pedicels: lid conical: anthers kidney-shaped, opening by divergent longitudinal slits. F. v. M. Eucal. 1:5.—*E. microthèca*, F. v. M. Placed next to E. siderophloia in the key. Lid not exceeding 2 lines in length: fr.-valves much exserted. F. v. M. Eucal. 10:6. One of the best trees for desert tracts; tolerates the intense, scorching heat of a desert summer, and a winter temperature of 18° F. Timber valuable for cabinet work, etc.—*E. miniàta*, Cunn. Placed after E. paniculata in the key. Fls. in simple umbels, brilliant orange-color: fr. with 3 or more cells, nearly 2 in. long. F.v.M. Eucal. 6:4. A handsome ornamental tree.—*E. obtusiflòra*, Auct.=virgata (below).—*E. pinnàta*, a garden name. Is a synonym of some other species.—*E. tetráptera*, Turcz. Shrub, 10 ft. high: fls. very large, axillary, solitary, on a recurved, flat, and very broad peduncle; calyx tube almost obverse-pyramidal, sharply quadrangular, broader than the pyramidal-conical lid: stamens red. F. v. M. Eucal. 2:10. One of the most ornamental species of the genus.—*E. virgàta*, Sieb. (E. obtusiflora, DC.). Placed second after E. obliqua in the key. Shrub, 10–15 ft. high: bark smooth: lvs. large, falcate: umbels generally enclosed in large bracts while in bud.

J. BURTT DAVY.

EUCHARÍDIUM (from the Greek for *charming*). *Onagràceæ*. Two Californian herbs allied to Clarkia, but differing in having the calyx tube much prolonged beyond the ovary, stamens 4 and opposite the sepals and not appendaged at the base. **E. concínnum**, Fisch. & Mey. (*E. grandiflòrum*, Fisch. & Mey.), is a graceful garden annual, growing 1 ft. high. Pubescent or glabrous: lvs. small, oblong, petioled, entire: fls. rose-colored, nearly or quite an inch across; calyx tube fili form, an inch or more long; filaments filiform; petals 3-lobed. Of easy culture in any garden soil. B.R. 23:1962. B.M. 3589. R.H. 1846:81; 1857, p. 299. **E. Bréweri**, Gray, is an annual 1 ft. high. Lvs. 1 in. or more long, narrow-lanceolate: petals large, obcordate, with a narrow lobe in the deep terminal sinus: filaments club-shaped.

L. H. B.

EÙCHARIS (*very graceful*, from the Greek). *Amaryllidàceæ*. Perianth tube straight or curved, the throat dilated; segments broad and spreading; perianth cup either entire or toothed between the filaments: ovules 2 to many in each of the 3 locules: fls. white, in umbels, very showy, standing on long, stout scapes: lvs. broad-ovate, narrowed into distinct petioles. Six or eight handsome species from Colombia. Rootstock short and bulb-like. The species are confused. *E. grandiflora*, *E. candida* and *E. subedentata* are the well-marked types. The fls. in Fig. 789, adapted from authentic plates, will distinguish the types. Hybridizes with Urceolina (see *Urceocharis*). Monogr. by Baker, Amaryllideæ.

L. H. B.

The Amazon Lilies, as Eucharis are popularly called, are among the most desirable of warmhouse bulbous plants, being not only very beautiful but also very free in the production of flowers.

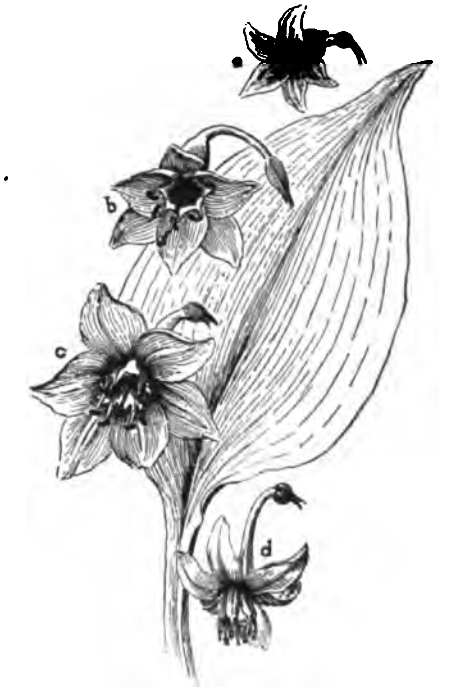
When grown in pots, they require a coarse, fibrous soil, composed chiefly of rotted sod, and enriched with about one-fourth of dry cow manure and a sprinkling of bone dust. The pots should be well drained, for much water is needed during the growing season, but frequent potting should be avoided, as the roots are impatient of disturbance. Shading from full sunshine is required, except during the winter months, and a night temperature of 65–70° is best for these plants. By drying off the Eucharis to some extent for a few weeks, a crop of flowers may be had at almost any season, providing the bulbs are strong and healthy, but they should never be dried to such a degree that all the foliage is lost, else the bulbs will be much weakened.

Good results are also had from planting out the Eucharis on a bench in a warmhouse, the soil and treatment being much the same as for pot-grown specimens. The only insects liable to give much trouble in connection with these plants are mealy bugs and thrips, and these may be controlled by thorough syringing.

W. H. TAPLIN.

A. *Cup toothed and protruded from the perianth-tube.*

grandiflòra, Planch. (*E. Amazónica*, Lind.). AMAZON LILY. STAR OF BETHLEHEM (a name also applied to Ornithogalum). Fig. 789. Bulb globular, 2 in. in diam.: lvs. 2–4 to each stem: scape 1–2½ ft., bearing an umbel of 2–4 large (4 in. across), very fragrant star-like fls. on pedicels nearly or quite 1 in. long; the segments oblong and obtuse; cup forming a distinct projecting tube. F.S. 9:957; 12:1216–17. B.M. 4971. Gn. 48, p. 217. G.C. III. 7:193; 16:665. A.F. 5:363; 8:445. F.E. 8:1000. F.R. 1:11; 2:364.



789. Eucharis.
Leaf of E. grandiflora, and fls. of (a) subedentata, (b) Sanderi, (c) grandiflora, (d) candida.

Var. **Moòrei**, Baker, may be expected to appear in the Amer. trade. It has smaller, rounder and thicker lvs. and smaller fls., with the cup lined with yellow.

Mástersii, Baker. Bulb often smaller: scape 1 ft. high, bearing 2 nearly sessile fls. in the umbel, the perianth segments ovate and spreading and shorter than in the last: cup forming a shallow frilled or notched collar. B.M. 6831. G.C. II. 24:721.—Possibly a hybrid of *E. grandiflora* and *E. Sanderi*.

AA. *Cup almost entirely joined or adnate to the perianth-tube* (*the winged filaments may project*).

cándida, Planch. Fig. 789, *d*. Bulb globose, bearing stolons, 2 in. in diam.: scape somewhat flattened, glaucous, 1–1½ ft. high, bearing 6–10 short-pedicelled fls.

in an umbel: segments oblong, acute, more or less reflexed: winged yellow filaments projecting, united at the base only. F.S. 8:788.—Smaller-fld. than *E. grandiflora*.

Sánderi, Baker. Fig. 789 *b*. Bulb ovoid, 1-2 in. in diam.: scape terete, 1 ft., bearing 2–3 nearly sessile white fls.: segments ovate, 1 in. or more long: yellowish cup, very narrow, like a collar or rim, and bearing the short, curved filaments on its edge. B.M. 6676. G.C. II. 19:349.—By some thought to be a hybrid of *E. grandiflora* and *E. candida*. Var. **multiflòra**, Baker. Fls. smaller, 4–6, striped green. B.M. 6831.

subedentàta, Benth. (*Calliphrùria subdentàta*, Baker). Fig. 789 *a*. Bulb ovoid, 1½ in. in diam.: scape slender, 1 ft.: fls. 6–8, on pedicels 1 in. or less long; tube 1 in. long, funnel-shaped above; segments oblong, ascending, 1 in. long; cup wanting, or represented only by obscure teeth on the filaments. I.H. 28:415. B.M. 6289.—A small-fld. species.

E. Bakeriàna, N. E. Br. Has the perianth of E. grandiflora and stamens of E. candida: fls. 2½ in. across, pure white: tube not enlarging emphatically at the top: cup projecting from the bases of the segments, not toothed. B.M. 7144. G.C. III. 7:417; 12:209.—*E. Elmetàna*, Sander. Hybrid of E. Sanderi and E. grandiflora. Easier to grow than E. Sanderi. G.C. III. 26:345.—*E. Lèhmanni*, Regel. Fls. about 4, 1½ in. across, the spreading corona with 12 long, narrow teeth, the perianth segments spreading or reflexed. Gt. 38:1300.—*E. Lòwii*, Baker. Robust: fls. 4 in. across, the spreading outer segments 1 in. wide and the 3 inner ones incurved. Perhaps a natural hybrid of E. grandiflora and E. Sanderi. G.C. III. 13:539; J.H. III. 28:111.—*E. Stèvensi*, N. E. Br. Free-flowering: very like E. Sanderi, and a garden hybrid of that species and E. candida. J.H. III. 30:253. Gn. 46:974. G.C. III. 17:365. L. H. B.

EUCNÌDE (Greek-made word, referring to the sharp, nettle-like hairs). *Loasàceæ*. Three western American herbs, by some authors referred to Mentzelia. Fls. yellow; calyx-tube oblong, the limb persistent, 5-lobed; petals 5, united at the base and inserted on the throat of the calyx; stamens numerous, the filaments filiform: ovary 1-loculed, bearing a 5-cleft style. **E. bartonioìdes**, Zucc. (*Mentzèlia bartonioìdes*, Benth. and Hook.), is sometimes cult. It is a pretty summer-flowering annual, thriving in warm garden soil. Stems about 1 ft., more or less decumbent, hispid-hairy: lvs. alternate, petioled, broad-ovate and toothed-lobed: fls. large, on long pedicels, the petals ovate-pointed, the numerous yellow hair-like stamens projecting and brush-like. It is half succulent. Mex. and Tex. B.M. 4491, as *Microspérma bartonioìdes*, Walp. L. H. B.

EUCODÒNIA is now referred to *Achimenes*.

EUCÒMIS (Greek, *beautiful hair*). *Liliàceæ*. Cape bulbs, half hardy, producing great radical rosettes of long leaves and a strong, leafy-topped spike of greenish flowers from the center. Fls. regular, 6-parted, rotate; stamens 6: ovary broad and short, obtusely 3-angled. Prop. by offsets. The bulbs may remain in the open if in a warm place and well protected. Will stand considerable frost. Of easy culture. Let the bulbs remain where planted. In the N. treated as glasshouse plants.

undulàta (*E. règia*, L'Her.). Royal Crown. Lvs. long-oblong, spreading or recurving, undulate: scape 2 ft., bearing very numerous green or yellow-green fls. underneath a crown or canopy of lvs.: bulb ovate. B.M. 1083.

punctàta, L'Her. Pineapple Flower. Lvs. erect-spreading, long and narrow, channeled, undulate, brown spotted beneath: scape 2 ft., spotted: fls. green, the ovary brown. B.M. 913. F.S. 22:2307. A form with lvs. striped beneath with brown is var. *striàta*, Sims. (B.M. 1539.)

bícolor, Baker. Stamens and margins of perianth segments bright purple, otherwise close to *E. punctata*, but lvs. unspotted (said to be a spotted var.). Foreign dealers offer var. *maculàta*. L. H. B.

EUCRŶPHIA (Greek for *well covered*). *Rosàceæ*. Three or four southern hemisphere resinous trees or shrubs, with opposite, evergreen simple or pinnate lvs. and showy white fls. *E. pinnatifòlia*, Gay, is a shrub hardy in parts of England, with large white hypericum-like 4-petaled fls. and rose-like foliage. B.M. 7067. G.C. II. 14:337; III. 9:613; 10:217; 15:109; 23:15 (fr.). *E. cordifòlia*, Cav., has 5 petals and simple serrate lvs. G.C. III. 22:247.—Neither of these is in the American trade. Worthy of trial in the South.

EUGÈNIA (named in honor of Prince Eugene of Savoy). *Myrtàceæ*. Trees or shrubs: lvs. evergreen, opposite, mostly finely penniveined: fls. white or creamy: fr. a drupe-like berry, usually globular and 1-seeded. Habit and inflorescence of Myrtus. For cult. and prop., see *Myrtus*. See *Myrtus*, also, for *E. Ugni*.

A. *Fls. solitary on axillary peduncles: petals free.*

Michelii, Lam. Cayenne, or Surinam Cherry. Pitanga. Shrub, 20 ft.: lvs. ovate-lanceolate, glabrous: peduncles shorter than the glossy lvs.: berry cherry-like, ribbed, about 1 in. in diam., edible, with a delightful spicy, acid flavor. Ripe in May and June. Brazil. Hardy in southern Fla. and southern Calif. R.H. 1889, p. 532.—Much esteemed for jellies, and in great demand. Useful, also, as a pot-plant, freely producing its showy red fruits.

Brasiliénsis, Lam. Grumichama of Brazil. Shrub, 6 ft.: lvs. oval or obovate-oblong, bluntish, scale-like along the branches, 3 in. long, 1½ in. broad: fr. edible, scarlet, the size of a cherry. April. B.M. 4526. R.H. 1845:425.

AA. *Fls. in 3-forking panicles or cymes; petals free and spreading.*

myrtifòlia, Sims (*E. austràlis*, Wendl.). Brush Cherry. Shrub, 6–12 ft.: lvs. petiolate, 2–3 in. long, obovate to nearly lanceolate, rather thick, dark and glossy green: peduncles 3–5-fld.: fr. edible, red or violet, about 8 lines in diam., crowned by the persistent calyx lobes. Austral. Hardy in the South. A.G. 11:756. B.M. 2230.—Chiefly grown for ornament. Used for hedges in Calif.

Jámbos, Linn. Rose Apple. Jamrosade. Jambos. Tree, 20–30 ft.: lvs. narrow-lanceolate, acuminate, long, thick and shining, resembling those of an oleander: fr. 1½–2 in. thick, white or yellowish, with a tinge of blush-pink on one side, edible, rose-scented, apricot-flavored. E. Indies. Stove. B.M. 1696.—Valued for jelly-making.

AAA. *Fls. in 3-forking panicles or cymes; petals united into a calyptra.*

Jambolàna, Lam. Jambolan, or Jambolan Plum. Tall shrub or tree: lvs. obtuse or shortly acuminate, 4–6 in. long, 2–3 in. broad: berry edible, varying from the size of a cherry to that of a pigeon's egg. E. Indies.

E. apiculàta, DC., Chile, has oval apiculate lvs. and 3-fld. axillary peduncles. Perhaps a Myrtus. J. Burtt Davy

EULÀLIA. Treated under *Miscanthus*.

EULARIA. Misprint for *Eulalia*.

EULÒPHIA (Greek, *handsome crest*). *Orchidàceæ*, tribe *Vándeæ*. Terrestrial herbs with membranaceous lvs. and conspicuous pseudobulbs; scape basal, several-fld.: sepals and petals spreading, similar, ascending; labellum 3-lobed; pollinia 2.—The culture of Calanthe will apply to this genus.

maculàta, Reichb. f. Pseudobulbs ovate, compressed: lvs. ovate, spotted or blotched: fls. small; upper sepal hood-shaped, lateral ones acuminate, reddish brown; petals broader, white or pale rose; labellum cordate, with two crimson spots, triangular in outline, near the base, otherwise white. Braz. B.R. 8:618 (Angræcum).

scripta, Lindl. Lvs. linear, subdistichous: fls. purple and yellow; sepals and petals linear-oblong; labellum 3-lobed, lateral lobes rotund at the apices. Madagascar.

Oakes Ames.

EULOPHIÉLLA (diminutive of *Eulophia*). *Orchidàceæ*, tribe *Vándeæ*. Pseudobulbs fusiform, elongated: lvs. elliptic, plicate: raceme from the base of young growths, with violet rachis: fls. white, fleshy; labellum articulate with the base of the column. Two epiphytes, from Madagascar.

Elisabethæ, Lind. & Rolfe. Fls. 2–2½ in. across, usually 2–4 in the drooping cluster; sepals and petals ovate; labellum oscillatory; anterior lobe yellow. B.M. 7387. R.B. 21:181. I.H. 40:173.

Peetersiana, Kränz. (*Grammatophyllum Ræmplerianum*, Reichb. f.). Lvs. 2–4 ft. long: scape 3–4 ft. long: fls. 3–4 in. across: sepals bright purple and blotched at tip; petals purple, unblotched; lip white, purple-bordered, with 4 erect crests. G.C. III. 23:200. Gn. 53, p. 379. (See G.C. III. 26:353). OAKES AMES.

EUÓNYMUS (ancient Greek name). Syn., *Evonymus*. *Celastràceæ*. SPINDLE TREE. BURNING BUSH. STRAWBERRY BUSH. Ornamental, deciduous or evergreen shrubs of upright or sometimes procumbent or creeping habit, with opposite, simple lvs. and rather inconspicuous greenish, whitish or purplish fls. in axillary cymes; very attractive in fall, with their handsome scarlet, pink or whitish, capsular frs., showing the bright orange seeds when opening, and with the splendid fall coloring which most of the species assume, especially *E. alatus*, *E. Hamiltonianus*, *Europæus* and *atropurpureus*. The Spindle Trees grow in almost any soil, and are well adapted for shrubberies. Most of the cultivated deciduous species, except those from Himalayas, are hardy North, while of the evergreen ones only *E. radicans* is fairly hardy, and, on account of its greater hardiness, is often used North as a substitute of the ivy for covering walls, rocks and trunks of trees, climbing, if planted in good soil, to a height of 15 and sometimes 20 ft. *E. Europæus*, and South the evergreen *E. Japonicus*, are sometimes used for hedges. Prop. by seeds, usually stratified and sown in spring, or by cuttings of ripened wood in fall. The evergreen species grow readily from cuttings of half-ripened wood under glass in fall or during the winter in the greenhouse. Varieties are sometimes grafted or budded on stock of their typical species. About 40 species are known in the northern hemisphere, extending also from S. Asia to Australia. Shrubs or small trees, with usually more or less quadrangular branches and opposite, usually glabrous and serrate lvs.: fls. small, in axillary cymes, 4–5-merous, generally perfect; style and stamens short, the latter inserted on a disk: fr. a 3–5-lobed, somewhat fleshy capsule, each dehiscent valve containing 1 or 2 seeds enclosed in a generally orange-colored aril; the seed itself is usually white. The wood is tough, close-grained and light-colored, often almost white, and used, especially in Europe, for the manufacture of small articles. The bark of the American species has medical properties.

INDEX.

alatus, 3.
albo-marginatus, 12.
Americanus, 1, 8.
angustifolius, 1
argenteo - marginatus, 13.
argenteo - variegatus, 12.
atropurpureus, 6, 8.
aureo - variegatus, 12.
aureus, 12.
Bungeanus, 11.
Carrieri, 13.
columnaris, 12.
Europæus, 6.
flavescens, 12.
gravilis, 13.
Hamiltonianus, 9.
Japonicus, 12.
Koopmanni, 5.
latifolius, 7.
linifolius, 5.
Maackii, 9.
macrophyllus, 12.
medio-pictus, 12.
microphyllus, 12.
nanus, 5.
obovatus, 2.
pallens, 12.
pulchellus, 12.
pyramidalis, 12.
radicans, 13.
repens, 13.
reticulatus, 13.
robustus, 12.
roseo - marginatus, 13.
Sieboldianus, 9, 10.
subtriflorus, 3.
Thunbergianus, 3.
variegatus, 2.
verrucosus, 4.
viridi-variegatus, 12.
Yeddoensis, 10.

A. *Foliage deciduous.*

B. *Capsules tuberculate, depressed-globose: fls. 5-merous.*

1. **Americànus**, Linn. STRAWBERRY BUSH. Upright shrub, to 8 ft.: lvs. ovate-lanceolate or oblong-lanceolate, usually acute at the base, acuminate, crenately serrate, 1½–3 in. long: peduncle slender, few-fld.: fls. yellowish or reddish green: fr. pink. June. From southern N. York south, west to Tex. L.B.C. 14:1322. B.B. 2:394. —Var. **angustifòlius**, Wood (*E. angustifolius*, Pursh). Lvs. lanceolate or linear-lanceolate, half-evergreen South.

2. **obovàtus**, Nutt. (*E. Americànus*, var. *obovàtus*, Torr. & Gray). Procumbent shrub, with rooting stem and erect branches, to 1 ft.: lvs. obovate or elliptic-obovate, crenately serrate, light green, 1–2 in. long: fls. purplish: capsule usually 3-celled. May. From Canada to Indiana and Kentucky. G.F. 9:385.—It may be used for covering the ground under large trees, or for borders of shrubberies. Var. **variegàtus**, Hort., has the lvs. marked pale yellow.

BB. *Capsules smooth: fls. generally 4-merous.*

C. *Fr. divided to the base into 4 or less nearly separate pods.*

3. **alàtus**, Maxim. (*C. Thunbergiànus*, Blume). Spreading shrub, to 8 ft.: branches with 2–4 broad, corky wings: lvs. elliptic or obovate, acute at both ends, sharply serrate, 1–2 in. long: fls. 1–3, short-peduncled, yellowish: capsule purplish, small. May, June. China, Jap.—Var. **subtriflòrus**, Franch. & Sav. Branches not winged: fls. 1–5.

CC. *Fruit more or less 3–5-lobed.*

D. *Branches densely warty.*

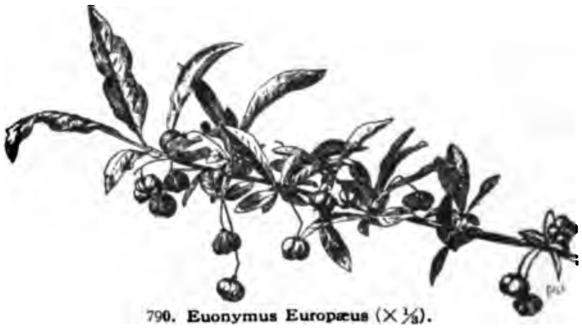
4. **verrucòsus**, Scop. Erect shrub, to 6 ft.: lvs. ovate-lanceolate, crenately serrulate, acuminate, 1–2½ in. long: fls. slender-peduncled, 1–3, brownish: capsule deeply 4-lobed, yellowish red; seed black, not wholly covered by the orange aril. Southeastern Europe, W. Asia.

DD. *Branches smooth.*

E. *Anthers yellow.*

5. **nànus**, Bieb. Low shrub, to 2 ft., with slender, often arching or sometimes procumbent and rooting branches: lvs. linear or linear-oblong, mucronulate, entire or remotely denticulate and revolute at the margins, ½–1½ in. long: fls. slender-peduncled, purplish: capsule deeply 4-lobed, pink; seed brown, not wholly covered by the orange aril. May, June. W. Asia to W. China.—Handsome shrub for rockeries and rocky slopes, forming a graceful, pendulous, standard tree if grafted high on *E. Europæus*. Fruit ripens in August, earliest of all species. *E. Koòpmanni* is a form of this.

6. **Europæ̀us**, Linn. Fig. 790. Erect shrub or sometimes small tree, to 20 ft.: lvs. ovate or oblong-lanceolate, acuminate, crenately serrate, 1½–2½ in. long: fls. yellowish, in few-fld. cymes: capsule 4-lobed, usually pink. May. Europe to E. Asia. B.B. 2:395.—Varying with narrower and broader lvs. There are also several varieties with variegated lvs. and some with frs. of different colors, as var. **frúctu atropurpùreo** with deep purple, **frúctu coccíneo** with scarlet, and **frúctu álbo** (var. *leucocarpa*, Hort.), with whitish frs. Var. **atropurpùreus**, Arb. Kew., has rather narrow purplish lvs.



790. Euonymus Europæus (× ⅓).

7. **latifòlius**, Scop. Shrub or small tree, to 20 ft.: winter buds slender, about ½ in. long: lvs. obovate-oblong, acuminate, crenately serrate, 2–4 in. long: fls. yellowish, often 5-merous, in slender-peduncled, rather many-fld. cymes: capsule pink, large, with winged lobes. S. Europe, W. Asia. B.M. 2384.—A very decorative species, with handsome foliage and large frs.

EE. *Anthers purple.*

F. *Fls. purple.*

8. **atropurpùreus**, Jacq. BURNING BUSH. Shrub or small tree, to 20 ft.: lvs. elliptic, acuminate, obtusely serrate, pubescent beneath, 1½–5 in. long: fls. purple, in slender-peduncled, many-fld. cymes: capsule deeply 3–4-lobed, scarlet. June. E. N. Amer., west to Montana. B.B. 2:394. *E. Americànus*, Hort.

FF. *Fls. yellowish or whitish.*

9. **Hamiltoniànus**, Wall. (*E. Maàckii*, Rupr.). Shrub, rarely small tree, to 30 ft., with almost terete branches: lvs. elliptic to ovate-lanceolate, acuminate, serrulate, 2–5 in. long: fls. in 3–12-fld. cymes: capsule deeply 4-lobed, with rounded valves, pink (yellowish in the Himalayan form); seed usually not wholly covered by the aril, grayish brown. June. Himalaya to Manchuria. Var. **semipersistens**, Rehder (*E. Sieboldiànus*, Hort., not Blume). Lvs. elliptic, long-acuminate, half evergreen, keeping its bright green foliage South until midwinter: fr. bright pink, ripening very late.

10. **Sieboldiànus**, Blume (*E. Yeddoénsis*, Hort.). Shrub or small tree, to 25 ft.: lvs. ovate-elliptic or elliptic, crenately serrate, shortly and abruptly acuminate, usually puberulous on the veins beneath when young: lvs. 3–6 in. long, 1–2½ in. broad: cymes 5–20-fld.: capsule pink, slightly lobed and 4-angled, with 4 narrow, thick wings; seed scarlet. June. Jap.—This species is often confounded with the former, but easily distinguished by its larger and much broader lvs.

11. **Bungeànus**, Maxim. Shrub, to 15 ft., with slender branches: lvs. slender-petioled, ovate-elliptic or elliptic-lanceolate, long-acuminate, finely serrate, 2–4 in. long: fls. in rather few-fld. but numerous cymes: fr. deeply 4-lobed and 4-angled, yellowish: seeds white or pinkish, with orange aril. June. China, Manchuria, M.D.G. 1899:569.—Very attractive with its rather large, profusely produced frs., remaining a long time on the branches.

AA. *Foliage evergreen.*

12. **Japónicus**, Linn. Upright shrub, to 8 ft., with smooth and slightly quadrangular or striped branches: lvs. obovate to narrow-elliptic, cuneate at the base, acute or obtuse, obtusely serrate, shining above, 1½–2½ in. long: fls. greenish white, 4-merous, in slender-peduncled, 5- to many-fld. cymes: capsule depressed, globose, smooth, pink. June, July. S. Jap.—A very variable species. Var. **macrophýllus**, Sieb. (var. *robustus*, Hort.). Lvs. oval, large, 2½–3 in. long. Var. **microphýllus**, Sieb. (*E. pulchéllus*, Hort. *Eurya microphýlla*, Hort.). Lvs. small, narrow-oblong or oblong-lanceolate. Var. **columnàris**, Carr. (var. *pyramidàlis*, Hort.). Of upright, columnar habit: lvs. broadly oval. There are many varieties with variegated lvs.; some of the best are the following: Var. **argénteo-variegàtus**, Rgl. Lvs. edged and marked white. Var. **àureo-variegàtus**, Rgl. Lvs. blotched yellow. Var. **álbo-marginàtus**, Hort. Lvs. with white, rather narrow margins. Var. **mèdio-pictus**, Hort. Lvs. with a yellow blotch in the middle. Var. **pállens**, Carr. (var. *flavescens*, Hort.). Lvs. pale yellow when young; similar is var. **àureus**, Hort., but the yellow is brighter and changes quicker to green. Var. **viridi-variegàtus**, Hort. (var. *Duc d'Anjou*, Hort.). Lvs. large, bright green, variegated with yellow and green in the middle.

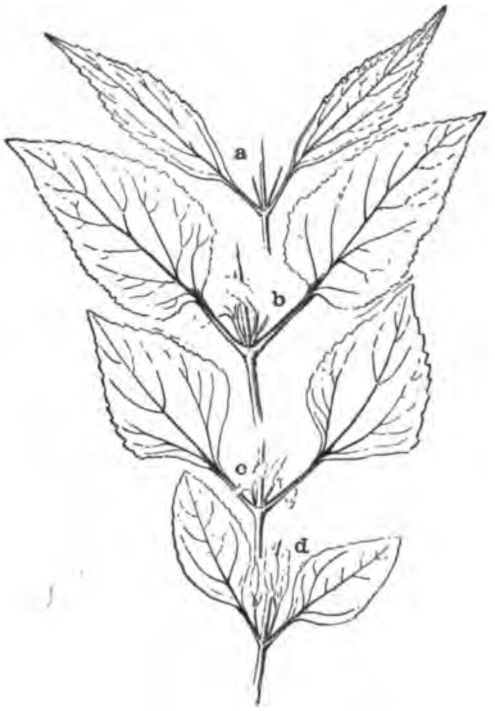
13. **radìcans**, Sieb. (*E. Japónicus*, var. *radìcans*, Rgl.). Low, procumbent shrub, with often trailing and rooting or climbing branches, climbing sometimes to 20 ft. high: branches terete, densely and minutely warty: lvs. roundish to elliptic-oval, rounded or narrowed at the base, crenately serrate, usually dull green above, with whitish veins, ½–2 in. long: fl. and fr. similar to the former, but fr. generally of paler color. June, July. N. and M. Jap. R.H. 1885, p. 295. G.C. II. 20:793.—Closely allied to the former, and considered by most botanists as a variety; also very variable. Var. **Carrièri**, Vauv. Low shrub, with ascending and spreading branches: lvs. oblong-elliptic, about 1½ in. long, somewhat shining. Var. **argénteo-marginàtus**, Hort. Lvs. bordered white. Var. **ròseo-marginàtus**, Hort. Lvs. bordered pinkish. Var. **reticulàtus**, Rgl. (var. *pictus*, Hort., var. *argénteo-variegàtus*, Hort.). Lvs. marked white along the veins.

E. echinàtus, Wall. Usually creeping or climbing, with rooting branches: lvs. ovate-lanceolate: fr. spiny. Himal. B.M. 2767.—*E. fimbriàtus*, Hort., not Wall.=pendulus.—*E. grandiflòrus*, Wall. Shrub, to 12 ft.: lvs. obovate or obovate-oblong, finely and acutely serrate: fls. white, four-fifths of an in. across: fr. globose, yellow. Himal.—*E. occidentàlis*, Nutt. Shrub, to 15 ft.: winter buds rather large: lvs. ovate or elliptic-lanceolate, irregularly serrulate: fls. 5-merous, purple: fr. slightly lobed. Ore., Calif.—*E. oxyphýllus*, Miq. Shrub or small tree: lvs. ovate or obovate, acuminate, rather large, serrulate: fls. 5-merous, purple or whitish: fr. globose. Jap.—*E. péndulus*, Wall. (E. fimbriatus, Hort.). Evergreen, small tree, with pendulous branchlets: lvs. oblong-lanceolate, sharply serrate, shining, 3–6 in. long: fr. with 4 tapering wings. P.F.G. 2:55. F.S. 7, p. 71.

ALFRED REHDER.

EUPATÒRIUM (from an ancient personal name). *Compósitæ*. More than 400 species, mostly of warm or tropical countries, herbs or shrubs. Heads discoid (rayless), the florets 3 to many, perfect: involucre cylindrical, bell-shaped or hemispherical, the imbricated bracts in 2 or more series: receptacle flat or conical, naked: corolla regular, 5-toothed, slender-tubed: akenes 5-angled, truncate: pappus a single row of hair-like, scabrous bristles: perennials.

Gardeners know two classes of Eupatoriums, the glasshouse and the hardy kinds. The latter are native species which only lately have been introduced to the trade as border plants. The glasshouse species are seen only in the larger or amateur collections, as a rule, although some of them are old garden plants. They are confused as to kinds. These species demand the general treatment of Piqueria (or Stevia),—a cool or intermediate temperature and pot culture. They are easy to grow. Prop. readily by cuttings. They are useful for winter bloom. Of all Eupatoriums the individual heads are small, but they are aggregated into showy masses. For *E. cælestinum*, see *Conoclinium*.



791. Leaves of glasshouse Eupatoriums (× ½).

a, *E. riparium*; b, *E. triste*; c, *E. glandulosum*; d, *E. glabratum*.

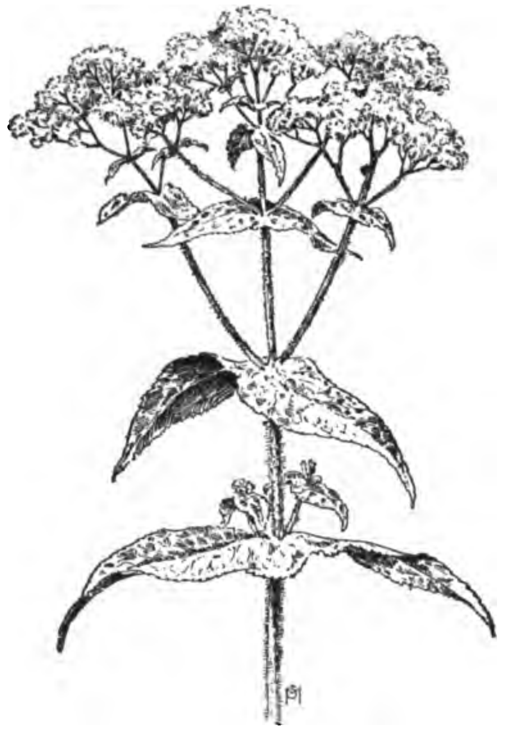
A. *Glasshouse or warm-country species.*

B. *Heads purplish.*

serrulàtum, DC. Shrubby: stems pubescent: lvs. opposite, very short-stalked, lanceolate or lance-oblong, the stalk ciliate, toothed and prominently nerved: heads aggregated into large purple or rosy tufts. Brazil and Uruguay. R.H. 1894:304. Gt. 44, p. 570. G.C. III. 18:265.—Choice.

atrórubens, Nicholson (*Hebeclìnium atrórubens*, Lem.). Lvs. large, ovate-pointed, ciliate and hairy on the reddish veins, opposite, toothed: heads red or purple, aggregated into a very large red-rayed truss. Mex. I.H. 9:310.

iánthinum, Hemsl. (*Hebeclinium iánthinum*, Hook.). Sub-shrub, but soft-wooded, the terete branches rusty-pubescent: lvs. opposite, long-petioled, cuneate-ovate and serrate: fls. light purple, in a large, compound, terminal corymb. Mex. B.M. 4574.



792. Eupatorium perfoliatum (×⅓).

BB. *Heads white (plants valuable for cut-flowers).*

glechonophýllum, Less. (*Agerátum conspicuum*, Hort.). Half shrubby: lvs. opposite, oval-pointed or ovate-lanceolate, nearly glabrous, 3-nerved, toothed, petiolate: fls. pure white, about 30 in each head. Chile.—Tender glasshouse perennial; but it may be flowered in the open the first year if seeds are sown early.

ripárium, Regel. Fig. 791 *a*. Diffuse, becoming woody at base, 2 ft., the stems thin and usually reddish and puberulent: lvs. opposite, lanceolate-acuminate, narrowed into a long petiole, prominently 3-ribbed, dentate or crenate-dentate: heads in rather compact, long-stalked clusters. S. Amer.—Good winter bloomer. Best for the florist.

triste, DC. (*E. triéste*, Hort.). Fig. 791 *b*. Strong herb (sub-shrub in the wild), with hairy more or less angled or striate stems: lvs. long-petioled, ovate or oblong-ovate, hairy and rugose (reminding one of elm or nettle lvs.), very veiny, crenate-dentate: fls. many, bright white, in a large, terminal corymb. Mts. of Jamaica.—Now becoming popular as a pot subject and for cut-flowers.

glandulósum, HBK. (*E. adenóphorum*, Spreng. *E. adenánthum*, Hort., not DC. *E. Americánum*, Hort.). Fig. 791 *c*. Diffuse, at length somewhat decumbent at base, the branches glandular-hairy: lvs. deltoid- or cuneate-ovate, slender-petioled, coarsely and sometimes unevenly crenate-dentate, sparsely pubescent below: heads pure white, ageratum-like, in close clusters. Mex.

glabrátum, HBK. (*E. élegans*, Hort. *E. latifólium*, Hort.). Fig. 791 *d*. Shrubby, erect, with thin, hard, glabrous brown stems: lvs. thickish, small, lance-oblong or ovate-oblong, tapering into a strong petiole, blunt-acute, undulate or small-toothed: fls. (sometimes blush) in ascending clusters, which combine to form a strong, terminal panicle. Mex.

AA. *Hardy or border plants.*

B. *Heads purple.*

purpúreum, Linn. JOE-PYE WEED. Tall, rank plant of low grounds (reaches 8–9 ft.): lvs. whorled, oblong or lanceolate, acuminate, coarsely serrate and veiny: heads in large, compound clusters, purple to flesh-color (rarely almost white). Var. **maculátum**, Darl. (*E. maculátum*, Linn.), is mostly lower and roughish pubescent, the stem purple-marked. Var. **amœ́num**, Gray. Still lower, (2 ft. high), nearly glabrous, the lvs. often opposite.—A good species for bold effects in a border or against shrubbery. Common, and widely distributed.

BB. *Heads white.*

C. *Lvs. perfoliate (united around the stem).*

perfoliátum, Linn. BONESET. THOROUGHWORT. Fig. 792. Stout, rank-smelling, pubescent, 3–5 ft.: lvs. lanceolate, rugose and pubescent, finely toothed: heads in dense white cymes.—Common in low ground. Much used in domestic medicine. Excellent for striking effects, particularly in low grounds.

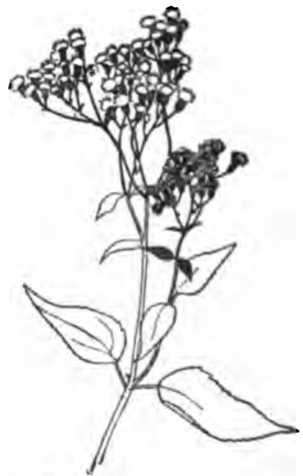
CC. *Lvs. not perfoliate.*

altíssimum, Linn. Tall (reaches 7–8 ft.), densely pubescent, branchy: lvs. opposite, lanceolate-acuminate, the petiole very short, remotely dentate or entire: heads only 5-fid. Open places, Pa. southward.

álbum, Linn. One–3 ft., pubescent: lvs. opposite, nearly or quite sessile, oblong or lance-oblong, coarsely serrate. Sandy soil, E. states.

ageratoides, Linn. f. WHITE SNAKEROOT. Fig. 793. Neat, glabrous, branchy herb, 3–4 ft.: lvs. opposite, thin, ovate with broad base, acuminate, coarsely and sharply toothed: heads small, in a loose but ample inflorescence. Rich woods, Can. to La.

aromáticum, Linn. Resembles the last, but usually pubescent: lvs. thickish and blunt or merely acute, the teeth blunt, later-flowering. Dry soil, E. states.



793. Eupatorium ageratoides. (×⅓.)

Var. **melissoides**, Gray (*E. Fráseri* and *E. cordifólium*, Hort.). Slender and roughish, strict: heads 5–12-fid.: lvs. subcordate-ovate or oblong, obtuse, crenulate-dentate, sometimes with coarser teeth, the petioles very short. S. E. states.

Various species of the old genus *Hebeclinium* may be expected in amateur collections, especially *E. macrophýllum*, Linn. (H. macrophyllum, DC.), with very large subcordate-toothed lvs., purple heads and purple-hairy stems. R.H. 1866: 350. Other glasshouse species are: *E. grandiflórum*, André, with rugose cordate coarse-toothed lvs. and reddish heads (R. H. 1882:384); *E. Haageánum*, Regel & Kœrn., with oval-acuminate coarse-toothed lvs. and small, white heads; *E. micránthum*, Less., from Mex. (known in cult. as E. Weinmannianum, Regel & Kœrn.), with elliptic-lanceolate lvs. and large, fragrant white heads (Gn. 47, p. 444. G.C. II. 5:53); *E. próbum*, N.E. Br., with oval, velvety lvs., white heads, and whole plant glandular-sticky (G.C. III. 7:321).

L. H. B.

EUPHÓRBIA (classical name, said by Pliny to be in honor of King Juba's physician; possibly from the Greek word for fat). *Euphorbiáceæ*. SPURGE is a name sometimes applied to the genus as a whole, but is, perhaps, better restricted to one or more species. One of the largest plant genera, of perhaps a thousand species, not less than 700, of very diverse habit, and found in most temperate and tropical regions. Many are desert plants, and the greater number grow in dry and sterile places.

Herbs, shrubs or trees, often fleshy and cactus-like, or low and prostrate weeds; but all characterized by a single pedicellate-pistillate flower, with a 3-celled, 3-seeded ovary, without floral envelopes or with a minute calyx, surrounded by numerous staminate flowers consisting each of a single stamen, the insertion of which is represented by an articulation with the pedicel, the whole surrounded by a more or less cup-shaped involucre, with 5 lobes, and bearing 1–5 glands of various shapes between the lobes. The staminate flowers are usually subtended by minute bracts. The glands often bear petal-like appendages, the whole involucre (or cyathium) closely simulating a perfect flower (Fig. 794).

Most of the species have abundant milky juice, and the cactiform species have been thus distinguished from cacti, but many cacti also have milky juice. The juice of most species is acrid poisonous, especially if it comes in contact with mucous membranes or open sores. The juice from some of the species is used in medicine as a purgative.

Monographed by Boissier in DeCandolle's Prodromus, 15, pt. 2 (1862). See local floras and Norton, Rept. Mo. Bot. Gard. 11, for native species. Works like Nicholson's Gard. Dict. and Bois' Dict. d'Hort. describe a number of cultivated species. See also Fobe, in Monatsschrift für Kakteenkunde, 8:42 (1898).

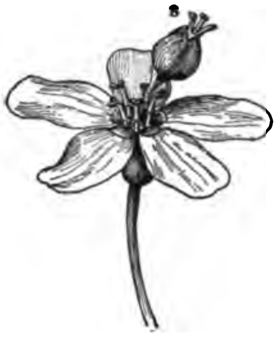
Many of the fleshy species are cultivated by lovers of succulents for their curious shapes; and a few are valuable for their ornamental foliage. The flowers are usually too minute to be noticeable. Some, like *E. corollata* (Fig. 794), *E. maculata*, *E. Cyparissias* and *E. marginata*, are weeds in America, but not troublesome. The great majority of the species are insignificant herbs. The species are remarkably free from injurious insects, and are rarely attacked by a few fungi.

The fleshy species are grown much the same as cacti (which see), but the culture is less difficult, and they do well with warmer treatment. In winter they are kept in a dry and cool house, 50° to 55° F., with good light and little water. Drips must be carefully avoided. In summer the pots should be plunged outdoors in hot, dry situations, with a moderate supply of water and especially good drainage. It is better to protect them from continued rain, but most species do well without this. The more fleshy species, like *E. Caput-Medusæ* and *E. meloformis*, require more heat and better care than the others. They are propagated by cuttings. Grafting has not been practiced to a great extent, as with cacti, but seems possible. They do not require a rich soil, and do well in a coarse, sandy loam, or some say in any kind of soil.

The shrubby species, like *E. atropurpurea* and *E. dendroides*, do well with the treatment of the more fleshy kinds. See D. A. W. and F. S. Curtis, in Sharon Cactus Guide, Mar. and May, 1897.

The few hardy species of ornamental value make good border plants or are suitable for the rockery. They are mostly propagated by division. The annuals are easily grown from seeds.

E. pulcherrima and *E. fulgens* are good winter-flowering greenhouse plants, and require special treatment. *E. fulgens* succeeds well in the warmest parts of the house, in pots, or best planted out like roses and trained upon the wall or strings. It is propagated from cuttings taken in June, when the old plants have started to grow, kept in a warm frame until rooted, and then kept growing with heat, any transfers being made with as little root disturbance as possible. If stocky show plants are wanted, several cuttings may be planted in one pot and checked two or three times during summer by repotting, and kept pinched back freely to secure branches. They are best kept cooler when in flower, but are very sensitive to cold or sudden changes in temperature. After flowering they are kept dry for a few months. For the cut sprays they are best grown from cuttings each year. They last very well when cut. The culture of the Poinsettia is very similar. To secure plants with large heads, the general plan is to grow from cuttings annually, but the old plants may be continued. Old plants that have been resting may be introduced to heat and moisture in late spring, and will soon give a liberal supply of cuttings, which are usually taken from the young wood. Successive sets of cuttings may be made at later periods if different sized plants are wanted. When well started, the potted plants are plunged outdoors till September, with plenty of water, light and sunshine and good drainage. They do well in rich, heavy loam in 5–7-in. pots. They are apt to drop their leaves if exposed to cold or other unfavorable conditions. In autumn they are transferred to the greenhouse, with moderate temperature. When the bracts begin to appear, give more heat and some manure water to expand them. When in flower, reduce the temperature to preserve them longer. After flowering the pots may be stowed away in a dry, warm place till spring,—under the benches will do. When the buds are cut the great objection is that they wilt easily. This may be obviated by dipping the cut ends in boiling water, or keeping them in water for a few days before using. See Grieve. G.C. III. 9:106, and Hatfield in Gard. and Forest 9:496.



794. Flowers of Euphorbia corollata (× 2). The pistillate flower is at 8.

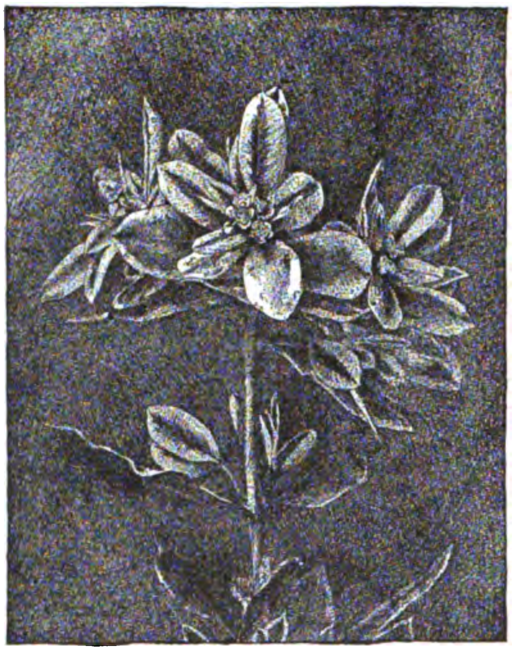
E. splendens is another winter bloomer, and may be treated as the succulents, with more heat and water. It will do well in living rooms, and bears some flowers all the year. It bears rough treatment well, and is propagated by cuttings from the young growth, which root with the greatest ease.

J. B. S. NORTON.

CULTURE OF POINSETTIA.—*Euphorbia pulcherrima* and varieties are fine shrubs, evergreen or deciduous, according to the climates in which they are grown. They are found at considerable elevations in Mexico, and subtropical conditions encourage their highest development. The original plants were introduced by a Dr. Poinsett, of Charleston, S. C., who sold them to the late Robert Buist, about 1833. Buist was a famous Scotch nurseryman of Philadelphia, who, during the early seventies, also distributed the so-called double variety. He sent both forms to Europe, and never quite forgave the botanists for changing the name which he gave the plant—*Euphorbia Poinsettiana*.

Under natural conditions Poinsettias form large bushes from 5–10 feet high and 12 or 14 feet in diameter, with woody bases and hollow annual growths. Flowers small, yellow, surrounded by an involucral crown of intense crimson leaves, the whole as large as a sombrero when well developed, varying to the smaller growing variety with creamy white bracts. Their highest development has been noted at Kotergherry, on the Nilgiri mountains of South India, at an elevation of about 6,000 feet, with a rainfall of 50 inches. The minimum temperature varies from 51° F. in January to 60° in July and August, the maximum from 66° F. in January, gradually increasing to 70° in July and August. In parts of the Mediterranean basin, in southern California and similar climates, and in many parts of the tropics at the sea level, the plants are grown, but do not reach such great perfection, for they become deciduous and often stunted. The period of flowering in the northern hemisphere is from late November to March.

There are several ways of managing the plants in cultivation. They are propagated by single eyes, by 4- or 5-inch cuttings of the one-year-old wood, or by young shoots with a heel of hard wood about March, or by the green tops about the end of August. If they are intended for pot culture as large plants, they simply require shifting along to 8- or 10-inch pots, with good drainage and good, turfy soil, with rather more sand than is commonly used for roses. After these large plants have bloomed, they may be stowed away to rest in a dry, light shed with a temperature of not less than 50°. Do not water them, and before the buds wake up in spring, shake them out, prune them to an eye or two, cut out the dead parts, repot them, and presently they will start to grow again. They may be gradually hardened, plunged outdoors and grown in the full sun during summer, giving them a shift during growth if extra luxuriance is desired. If bench culture is desirable, plants may be turned into the ground from 4-inch pots, or even from the propagating bed, grown until the end of August or later southward, the leaves stripped from all the stems but the upper foot or so, lifted, and laid flat on the benches, with a bushel or so of good soil over the roots and about an inch over the benches in the spaces. The next rank of plants may have their tops laid well over the roots of the first, and so proceed until all are planted. The ends soon turn up as growth starts, and the heads are very large and fine with suitable temperature and attention. Sometimes mealy bug gets into the heads. It may be driven out by a moderate stream of water from a hose, supporting the heads with one hand to avoid breaking. They are quite brittle. The milkiness produced by cutting may be got rid of by standing the stems in water, for it is sticky, stains, and is disagreeable. For small pot-plants the green tops, about 6 or 8 inches long, may be taken in August, dibbled into well drained 4-in. pots, set on mild bottom heat, or placed in a rather humid equable temperature southward. They must not be over-watered or too densely shaded, when they will soon strike, form handsome little plants, often with leaves to the pots, and be very useful for many purposes. For detailed points by professional growers, see A.F. 11:285, 457; 12:536.


795. Euphorbia marginata (× ⅓).

JAMES MACPHERSON.

The following is an alphabetical list of the names in the American trade :

Abyssinica, 20.
alcicornis, 16.
antiquorum, 12.
arborea, 32.
atropurpurea, 29.
Beaumeriana, 23.
cærulescens, 19.
Canariensis, 18.
candelabrum, 22.
Caput-Medusæ, 24.
cereiformis, 26.
corollata, 2.
Cyparissias, 35.
dendroides, 31.
drupifera, 10.
echinus, 23.
erosa, 26.
fulgens, 3.
grandicornis, 13.
grandidens, 16.
grandifolia, 10.
Grantii, 32.
Havanensis, 12.
hæmatodes, 29.
heptagona, 26.
Hermentiana, 14.
heterophylla, 5.
Hystrix, 27.
jacquiniæflora, 3.
lactea, 12, 15.
Lathyris, 28.
mamillosa, 11.
marginata, 1.
meloformis, 25.
Mexicana ?
Myrsinites, 37.
Natalensis, 36.
neriifolia, 9.
Palmeri, 34.
pandurata, 5.
pendula, 6.
Pfersdorffii, 21.
Poinsettia, 4.
polygona, 26.
pulcherrima, 4.
Regis-Jubæ, 30.
rhipsaloides, 7.
robusta, 34.
sanguinea, 29.
splendens, 8.
Tirucalli, 7.
triangularis, 17.
variegata, 1.
virosa, 19.

A. *Involucres flower-like, with 4 or 5 petaloid appendages*

1. **marginàta**, Pursh (*E. variegàta*, Sims). SNOW-ON-THE-MOUNTAIN. Fig. 795. Plant 2 ft. high, pubescent, dichotomously many-branched : lvs. numerous, with stipules, light green, 1–3 in. long, ovate-subcordate to oblong-lanceolate, the upper ones margined, with white or some entirely white ; involucres in the forks of the branches, their appendages large, white. July–Oct. Plains from Dakota to Texas and extending eastward. B.M. 1747. Gt. 30:218.—Hardy annual, used for its white foliage in bedding and mixed borders in sunny situations.

2. **corollàta**, Linn. FLOWERING SPURGE. Fig. 794. Plant 1½–3 ft. high, usually glabrous, slender and diffusely branched above: lvs. without stipules, ovate-oblong to lanceolate, 1–2 in. long, those of the inflorescence much smaller and opposite ; appendages of the numerous involucres 5, white, conspicuous for the genus. July–Oct. Rather dry soil in east U. S. B.M. 2992. L.B.C. 4:390. F.R. 1:969.—A hardy herbaceous perennial, used like Gypsophila for cutting and as a bedder in light soil. Very variable in size and shape of plant, leaves and inflorescence.

3. **fùlgens**, Karwinsky (*E. jacquiniæflora*, Hook.). SCARLET PLUME. Fig. 796. Small shrub, with slender, drooping branches: lvs. long-petioled, lanceolate, bright green ; involucres in small axillary cymes, their 5 conspicuous bracts bright orange-scarlet. Mexico. B.M. 3673. G.C. II. 19:816.—A handsome winter-blooming plant, used for cut-flowers or for specimen plants.

AA. *Involucres without petaloid appendages to their glands, but the glands or subtending bracts sometimes colored petal-like.*

B. *Stem herbaceous or shrubby, not fleshy: upper leaves colored : stipules glanduliform : inflorescence cymose.*

4. **pulchérrima**, Willd. (*E. Poinsettiàna*, Buist. *Poinsettia pulchérrima*, Grah.). POINSETTIA. Fig. 797. A shrub, 2–6 ft. high, branched : lvs. ovate-elliptical to lanceolate, entire, sinuate-toothed or lobed, or panduriform, 4–6 in. long, somewhat pubescent, becoming narrower, more entire and of the brightest vermilion-red above ; involucres greenish, with one large yellow gland. Nov.–Feb. Moist, shaded parts of tropical Mexico and Central America. B.M. 3493. G.C. III. 21:125, 193.—Sometimes cut, usually used for specimen plants and in masses. A gorgeous plant. Varieties with white and yellow bracts occur. Var. **plenissima**, Hort., has a double series of bracts and forms a wider and higher head. G.C. III. 5:17.

5. **heterophýlla**, Linn. (*E. panduràta*, Hort.?). MEXICAN FIRE PLANT. HYPOCRITE PLANT. PAINTED LEAF. FIRE-ON-THE-MOUNTAIN. ANNUAL POINSETTIA. Annual, nearly glabrous, 2–3 ft. high : lvs. ovate and sinuate-toothed or fiddle-shaped, or some of them linear or lanceolate and entire, dark green, the upper bright red at the base or only the tips green, involucral glands 1 or 2. July–Sept. Eastern and central U. S. to Peru. Mn. 2, p. 53. Gt. 39, p. 105.—Easily grown in sunny places and also in pots indoors. White and yellow variegated forms are in cultivation in this country.

BB. *Stem more or less fleshy or spiny, often cactus-like: leaves small, none or soon deciduous; involucres single or few together.*

C. *Branches short cylindrical, smooth, quill- or rush-like, slender.*

6. **péndula**, Boiss. Branchlets many, slender, pendulous: lvs. very small, opposite. S. Africa ?

7. **Tirucálli**, Linn. (*E. rhipsaloìdes*, Lem.). A tree, 20 ft. high, with many slender subverticillate ascending branches ; twigs 4–8 in. long : lvs. 5–8 lines long, few, alternate. E. Africa and India.—A striking plant.

cc. *Branches fleshy, a spine on each side of every leaf or leaf-scar, in a few the leaf transformed into a third thorn between them.*

D. *Podaria (the projections bearing leaves and spines) distinct: branches cylindrical or obsoletely angled.*

8. **spléndens,** Bojer. Crown of Thorns. Fig. 798. Stems 3–4 ft. long, ½–1 in. thick, covered with stout spines almost an inch long, somewhat twining: branches few: lvs. few, on the young growth, obovate to oblong-spatulate, thin, bright green, 1–2 in. long; involucres in long-peduncled dichotomous cymes, near the ends of the branches, each closely subtended by two broadly ovate bright red bracts, filaments forked. Madagascar, flowering all the year, but mostly in winter. B.M. 2902. L.B.C. 18:1713.—Coolhouse plant. The red bracts, with green leaves on the sinuous spiny stems, are striking. It can be trained into ornamental forms.

9. **neriifòlia,** Linn. Arborescent or shrubby: stem obtusely 5-angled, 3–7 ft. or more high: the small mammiform podaria in rows, with short, dark colored, divergent spines: branches numerous, bearing obovate-oblong, obtuse, thick lvs., 3–5 in. long at the summit: small, sessile cymes of greenish involucres in the upper axils. June, July. E. Indies.—Large lvs. persistent from autumn to spring. Cristate forms are in cult.

10. **drupífera,** Schum. & Thorn. (*E. grandifòlia*, Haw.). Arborescent: stem terete: branches obsoletely 4–5-angled; spines small: lvs. terminal, obovate-cuneate, obtuse or retuse, 5–8 in. long: small cymes axillary, peduncled: capsule drupaceous. Guinea.

796. Euphorbia fulgens (× ⅓).

11. **mamillòsa,** Lem. Low, cespitose: branches less than an inch in diam.: podaria elongated, conical, in 5 spiral rows: lvs. and spines small, soon deciduous.

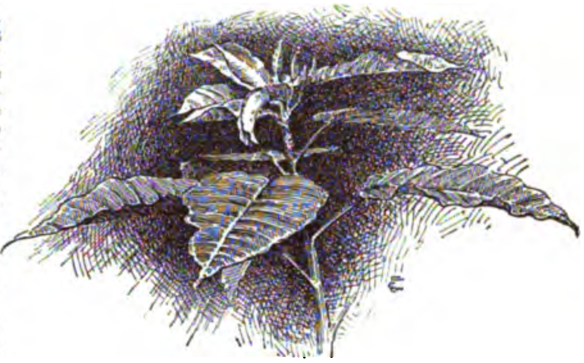
DD. *Podaria confluent into ribs: branches more or less acutely wing-angled.*

E. *Growths or branches 3-angled (sometimes 4-angled, especially on the main axis, and in E. alcicornis flat).*

12. **antiquòrum,** Linn. (*E. Havanénsis*, Hort.? *E. láctea*, Hort.?). Shrub, 8–10 ft. high: branches erect-spreading, jointed; angles compressed, repand dentate, the teeth 1 in. long; spines 1–3 lines long: lvs. minute, ovate-spatulate or rotund. India, and naturalized in other places, notably the W. Indies, where it is used for hedges.—Cristate forms are in the trade, as *E. lactea monstrosa?* and *E. Havanensis cristata*.

13. **grandicórnis,** Gœbel. Fruticose: branches 3 in. wide; angles broadly winged, deeply lobed and sinuate; spines large, 1–2 in. long, light colored. S. Afr. Neubert's Deutsche Garten Mag. 46:291.—A striking plant, with the widest wings and longest spines of all.

14. **Hermentiàna,** Lem. A shrub, 3–4 ft. high, with many non-jointed, erect branches, their edges repand-dentate and broad, slightly concave faces, white-marbled when young; spines 2–2½ lines long: lvs. lanceolate or lance-spatulate, 3–5 in. long. Gabon river, W. Afr.—Considered one of the best.



797. Euphorbia pulcherrima (× 1-5).

15. **láctea,** Haw. A shrub: branches erect; faces 1–3 in. wide, plano-convex, yellow and green striped; edges subcompressed, repand dentate; spines 2–3 lines long. East Indies.

16. **grándidens,** Haw. Tree, 20–30 ft. high and as much as 3 ft. in diam.: branches slender, ½–¾ in. wide, numerous, erect-spreading, making a rounded head in old plants; faces almost plane; angles deeply lobed-dentate; spines 3–5 lines long, slender: lvs. very small, triangular. S. Afr. G.C. II. 26:721.—**E. alcicornis,** Hort., is probably a form of this with flat branches.

17. **triangulàris,** Hort. Par. Stem 3–7 ft. high, triangular: numerous branches erect, with convex faces dark green; the winged angles sharply toothed and short-spined. S. Afr.

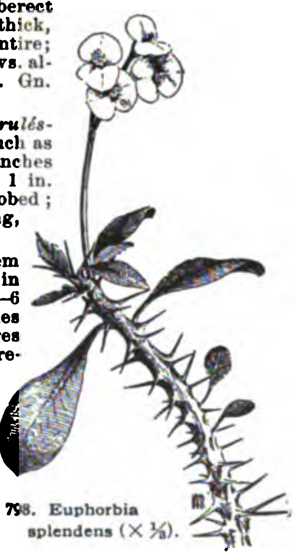
EE. *Growths or branches with 4 or more angles or rarely 3-angled.*

18. **Canariénsis,** Linn. Shrub or tree, 12–20 ft. high, with many 4–6-angled suberect branches, as much as 3 in. thick, from the base; angles subentire; spines 2 lines long, black: lvs. almost none. Canary Islands. Gn. 53, p. 46. G.C. II. 20:629.

19. **viròsa,** Willd. (*E. cærulés-cens*, Haw.). A shrub as much as 15 ft. high, much branched: branches 4–5- or sometimes 3-angled, 1 in. thick, ascending; angles lobed; epidermis bluish; spines strong, 4–5 lines long, black. S. Afr.

20. **Abyssínica,** Rausch. Stem robust, 30–40 ft. high, 9–14 ft. in greenhouses: branches few, 4–6 in. in diam., dark green; angles 5–8, obtuse but prominent; edges undulate; spines short, recurved: lvs. minute, spatulate. Abyssinia. Gn. 52, p. 106. G.C. III. 20:497.—Much resembles *Cereus Peruvianus*.

21. **Pférsdorffii,** Hort. Trunk round, 1½–2½ in. thick, 9-ribbed, much branched when old; spines large, 4–8 lines long.



798. Euphorbia splendens (× ⅓).

22. **candelàbrum,** Trem. & Klotzch. Tree, 20–30 ft. high, with a head 60–80 ft. in circumference: trunk short and thick, densely branched: branches 3–4-angled;

spines short. Trop. Afr.—See *E. Tirucalli* for some plants sold under this name.

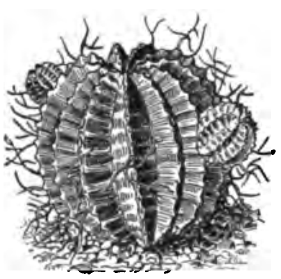
23. **officinàrum**, Linn. Fruticose: branches 2⅓–3 in. thick, 9–13-angled, deeply sulcate; edges repand; spines red, divergent or deflexed, 1–1½ lines long: lvs. minute. N. Afr. R.H. 1875:336–37.—**E. Beaumeriana**, Hook. & Coss., and **E. echinus**, Hook. & Coss., are closely related species from the same region.

CCC. *Branches with spines, if any, not stipular, but in the place of lvs. or branches*

D. *Spines not present.*

24. **Càput-Medùsæ**, Linn. MEDUSA'S HEAD. Stem short, obconical, fleshy: branches numerous from the apex, soon declined around the main stem with their ends erect, ⅓ in. or more in diam., 6–12 in. long, covered with depressed, keeled tubercles, each bearing a small. linear-lanceolate leaf; glands of the involucre white, rather conspicuous, the outer lip palmatifid. S. Afr. L.B.C. 14:1315.—Curious and rather rare. Var. **màjor**, Ait. (*E. Commelini*, DC.), is a large, erect, unbranched form, perhaps originating from branch cuttings.

25. **melofórmis**, Ait. Fig. 799. Globose or pyriform, 3–5 in. in diam., deeply 8–10-costate, the ribs obscurely tuberculate on the almost acute angles, the sides transversely dark and light green striped or wrinkled when old: the few small lvs. and fls. at the depressed apex: the old forked branches of the inflorescence subpersistent but not spinose. A few small branches similar to the main stem usually present. S. Afr. L.B.C. 5:436. A.G. 11:463.—A very interesting and rare plant in Amer. Best grown only under glass. Often mistaken for a cactus.



799. Euphorbia meloformis.

DD. *Spines formed of the sterile peduncles.*

26. **cereifórmis**, Linn. (*E. eròsa*, Willd.). Erect, 3 ft. or more high, little branched: branches erect, with 8–13 tuberculate ribs: lvs. very small: peduncles usually with only one involucre, the sterile ones forming dark colored spines 4–7 lines long. S. Afr. L.B.C. 14:1334.—**E. polỳgona**, Haw., with more prominent and spiral ribs, and **E. heptágona**, Linn., with 7–8 ribs and sulci between them more obtuse, are closely related South African species.

27. **Hỳstrix**, Jacq. A shrub, 2–3 ft. high, not ribbed: podaria depressed: lvs. 2–3 in. long, linear; spines numerous, 1–2 in. long, erect-spreading. S. Afr. Jacq. Hort. Schœnb. 207.

BBB. *Stems herbaceous or woody, scarcely ever slightly fleshy-stemmed: inflorescence umbellate: stipules none.*

C. *Lvs. below the umbel decussate: tall herbs.*

28. **Láthyris**, Linn. CAPER SPURGE. MOLE PLANT. Fig. 800. Annual, 2–3 ft. tall: lvs. long, lance-linear, those of the inflorescence ovate-acuminate; glands short-horned: capsules somewhat fleshy. Eu., and naturalized in eastern U.S. Rept. Mo. Bot. Gard. 11, pl. 11.—Cult. in old gardens. Capsules sometimes pickled. Seeds used as a purgative. Said to drive moles from its neighborhood (see Cornell Bull. 61:331).

CC. *Lvs. usually clustered at the ends of the branches: shrubs.*

29. **atropurpùrea**, Brouss. A shrub, 3–6 ft. high, branched: the pale, glaucous green, spreading or drooping lvs. crowded at the ends of the branches, 2–3 in. long: umbel 5–10-rayed; involucres surrounded by 2 large, dark purple, broadly ovate, obtuse, connate bracts. March. Teneriffe. B.M. 3321.—Plants known as *E. atropurpurea* and *E. sanguinea* in America, and used for bedding, are in part *E. hæmatodes*, Boiss., a species of Section A not well known to botanists, and partly a purplish var. of *E. pulcherrima*.

30. **Règis-Jùbæ**, Webb. Like the last, but lvs. narrowly linear and bracts not dark purple; involucral gland with 2 short horns. Teneriffe.

31. **dendroìdes**, Linn. A large, branching shrub, more foliaceous than the two preceding: leaves linear-lanceolate, obtuse or acute; floral leaves yellowish, rhomboid-orbicular, mucronate, glands truncate or semi-lunate. Mediterranean region. R.H. 1887:160. Gn. 36, p. 203.

32. **Grántii**, Oliv. Small shrub with lanceolate leaves, large, long acuminate, ovate bracts and palmate glands. E. Africa. This and the **E. arborea** offered by Blanc probably belong in this section, though the *E. Grantii* of American dealers may possibly be *Synadenium Grantii*, Hook.

CCC. *Lvs. below the umbel alternate; glands oval in the first species, in the others two horned: leafy herbs.*

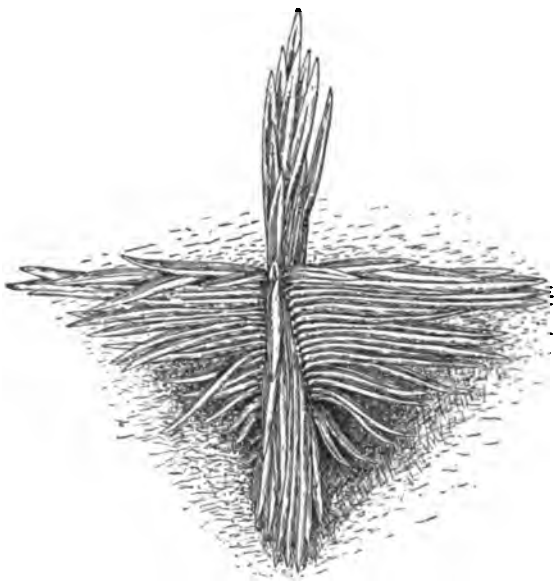
33. **epithymoìdes**, Jacq. (*E. polychròma*, Kern.). A herbaceous perennial, a foot or more high, with oblong, dark green leaves, floral leaves different shades of yellow at flowering time. May. Europe. B.M. 2258.—Growing in a fine, compact clump, uncommon in gardens.

34. **robústa**, Small, and **Pálmeri**, Engelm., are many-stemmed perennials, the former from the Rocky mountains, the latter from S. Calif., a foot high, more or less, with small ovate leaves and roughened seeds. They have been offered for sale, but have little cultural value.

35. **Cyparíssias**, Linn. Herb, perennial from root buds, the short plume-like branches covered with spreading, narrow linear, dark green leaves an inch long: seeds smooth. Europe. L.B.C. 2:118. G.C. II. 22:469. Rept. Mo. Bot. Gard. 11, pl. 50.—Cult. in old gardens for its moss-like growth. Naturalized and a weed in east U.S.

36. **Naturalénsis**, Bernh. Stems many, ⅓–1 ft. high: umbel 3–5-rayed, head-like: leaves crowded, narrow linear-lanceolate, subcoriaceous. S. Africa.

37. **Myrsinìtes**, Linn. Perennial herb: many declined stems covered with large, fleshy, glaucous, obovate or ovate-oblong, concave, pointed leaves: umbel 7–12-rayed: glands and flowers yellow. Europe.—A plant of old gardens, good for rockeries.



800. Euphorbia Láthyris.
Seen endwise to show 4-ranked leaves.

Plants in cult. in Europe but not in the American trade: Fleshy forms: *E. anacántha*, Ait.—*E. bupleurifòlia*, Jacq. Short, thick, scaly stem, with a cluster of large leaves at the top.—*E. Bòjeri*, Hook. Near E. splendens.—*E. Breòni*=E. Bojeri. —*E. Capénsis*, Hort.—*E. clandéstina*, Jacq.—*E. enneágona*, Haw.=cereiformis, Linn.—*E. fimbriàta*, Hort.?—*E. Fourniòri*, Rebut, a Madagascar species near E. lophogona, Lam.—*E. globòsa*, Sims. B.M. 2624.—*E. glomeràta*, Hort.—*E. helicothèle*, Lem.=E. Nivulia, Buch.—*E. imbricàta*, Vahl.—*E. Lemaireàna*, Boiss. Like E. grandicornis, but spines much shorter.—*E. lophógona*, Lam. Peculiar club-shaped stem, with large leaves above and cristate stipules. Madagascar.—*E. macroglýpha*, Lem.—*E. mamillàris*, Linn.—*E. Montieri*, Hort.—*E. pentágona*, Haw.—*E. piscatòria*, Ait.—*E. pyrifòlia*, Lam., near lophogona.—*E. serpifórmis*, Boiss.=E. scopiformis.—*E. squarròsa*, Haw.—*E. stapeliæfórmis*, Hort.—*E. tetrágona*, Haw.—*E. tithymaloìdes*, Linn.=Pedilanthus tithymaloides.—*E. trigona*, Haw.—*E. tuberculàta*, Jacq.—*E. xylophylloìdes*, Brongn.

Shrubby or tree-like forms: *E. balsamífera*, Ait.—*E. Berthelòti*, Bolle.—*E. colletioìdes*, Benth.—*E. laurifòlia*, Lam.—*E. mellífera*, Ait.—*E. mìsera*, Benth.—*E. plumerioìdes*, Teysman.—*E. punicea*, Swartz. G.C. II. 15:529.—*E. resinifera?*—*E. scolopéndria*, Don.

Herbaceous forms: *E. Aléppica*, Linn.—*E. Charàcias*, Linn.—*E. Chamæsỳce*, Linn.—*E. falcàta*, Linn.—*E. geniculàta*, Orteg.—*E. helioscòpia*, Linn.—*E. Ipecacuánhæ*, Linn. Plant of east U. S. coast region, root furnishing one of the officinal U. S. drugs.—*E. Lagáscæ*, Spreng.—*E. Paràlias*, Linn.—*E. pilòsa*, Linn.—*E. pilulífera*, Linn.—*E. spinòsa*, Linn.

Others not well known: *E. Amèlia*, Hort.—*E. aphýlla*, Brouss.—*E. articulàta*, Hort.—*E. aurèlia*, Hort.=E. Amelia?—*E. càput-odoràta*, Hort.—*E. Càput-Sìmiæ*, Hort.—*E. Cassýtha péndula*, Hort.—*E. colubrìna*, Hort.—*E. Coòperi*, Hort.—*E. dentàta*, Hort.—*E. de Smetiàna*, Hort.—*E. erécta*, Hort.—*E. fimbriàta*, Hort.—*E. funàlis*, Hort.—*E. gardeniæfòlia*, Hort.—*E. gràcilis*, Hort.—*E. Houlletiàna*, Hort.—*E. Houllèti*, Hort.—*E. Kràusii*, Hort.=E. Kraussiana?=E. erubescens, E. Mey.—*E. longifòlia*, Hort.—*E. Mángador*, Hort.=E. Mogador, Hort.?—*E. Mauritània*, L.—*E. Morìni*, Hort.—*E. obtùsa*, Hort.—*E. ornithopus*, Jacq.—*E. Pavoénsis*, Hort.—*E. púlchra*, Hort.—*E. Pulletiàna*, Hort.—*E. Rebùti*, Hort.—*E. Richárdi*, Hort.=E. Richardiana.—*E. Sahariénsis*, Hort.—*E. San Salvador*, Hort.—*E. serpentaria*, Hort.—*E. viperìna*, Hort.—*E. Waltonénsis*, Hort.

J. B. S. NORTON.

EUPTÈLEA (Greek *eu*, well, handsome, and *ptelea*, elm). *Trochodendràceæ*. Ornamental shrubs or small trees, with alternate, long-petioled, simple lvs. and small fls. appearing before the foliage, resembling somewhat the alder in habit and foliage. Three species from Himalayas to E. Asia, of which the half hardy Japanese species is sometimes cultivated; it prefers somewhat moist situations and is prop. by seeds or by grafting on their own roots.

polýgama, Sieb. & Zucc. Shrub or small tree, to 20 ft.: lvs. long-petioled, usually roundish ovate, cuspidate, coarsely and irregularly dentate, slightly pubescent on the veins beneath, 2–4 in. long: fls. in small, axillary, peduncled clusters, polygamous-diœcious, apetalous; stamens and carpels numerous: fr. consisting of many small winged nutlets, similar to the elm frs. Japan, China. S.Z. 72.

ALFRED REHDER.

EÙRYA (Greek for *large*, but of no application). *Ternstrœmiàceæ*. Perhaps 20 shrubs of southern Asia and Malaya, with small diœcious fls., berry-like frs., and simple, glabrous evergreen lvs.: fls. in axillary clusters, or rarely solitary; petals and sepals 5; stamens 15 or less (rarely only 5), joined to the base of the corolla: ovary usually 3-loculed. The Euryas are allied to Camellias, and require much the same treatment. They are grown for foliage rather than for fls. Demand an intermediate temperature and a peaty soil. Prop. by cuttings taken from the tips of growing shoots. **E. Japónica**, Thunb. (*E. Sieboldii*, Hort.), is the common species, and is very variable. The variegated form of it (known in the trade as *E. latifòlia variegàta*) is one of the best glasshouse decorative pot shrubs: lvs. variable in shape, usually ovate-acuminate and irregularly toothed or notched, short-petioled, irregularly blotched with white: fls. greenish white, in small, axillary clusters. Japan. V.M. 23:5.

L. H. B.

EURÝALE (mythological name). *Nymphæàceæ*. One species, the Indo-Chinese representative of *Victoria Regia*, from which it differs in having all the stamens fertile (in Victoria the inner ones are sterile) and in the very small flower, and in other technical characters. **E. fèrox**, Salisb., is the species. The lvs. are 1–4 ft. across, circular, purple and spiny-ribbed beneath, dark green and uneven above: fls. small, prickly outside, the calyx reddish inside and the 20–30 purple petals shorter than the calyx lobes; stamens numerous: fr. a small, many-seeded, globular berry, bearing the remains of the calyx on its top; seeds edible. B.M. 1447. Long cult. in China. Treated as an annual. Has attracted little attention since the introduction of Victoria. As far north as Philadelphia it is hardy, sowing itself every season. It is ferociously spiny.

E. Amazónica, Poepp., still advertised in catalogues, is Victoria Regia.

L. H. B. and WM. TRICKER.

EURÝCLES (Greek-made name, of no particular application). *Amaryllidàceæ*. Two south hemisphere bulbous plants, allied to Hymenocallis and Pancratium. Perianth-tube cylindrical, the segments oblong-lanceolate and nearly equal; stamens inserted in the throat of the tube: lvs. broad and stalked, with prominent curving veins and interlocking veinlets: fls. white, in umbels. Cf. Baker, Amaryllideæ, p. 130. **E. sylvéstris**, Salisb. (*E. Amboinénsis*, Loud.). BRISBANE LILY. Scapes 1–2 ft., bearing an umbel of 10–40 handsome, creamy white fls. (2 in. across), lvs. round-cordate, with a very short, blunt point. B.M. 1419, as *Pancratium Amboinense*. B.R. 9:715, as *Pancratium Australasicum*, Lindl. R.H. 1879, p. 456; p. 457 as *E. Australasica*, Loud. Malaya, Philippines, N. Australia. Grow in coolhouse, as for Pancratiums.

L. H. B.

EUSCÀPHIS (Greek, *eu* and *scaphis*, vessel; alluding to the shape and the handsome color of the dehiscent capsule). *Celastràceæ*. Ornamental shrub, with rather large pinnate, opposite lvs., small whitish fls. and attractive brownish red frs. in erect panicles, with shining black seeds. Monotypic genus allied to Staphylea, but with upright panicles and the capsules divided to the base into 3 dehiscent, leathery pods. It grows in almost any good garden soil, but is only half-hardy North. Prop. by seeds and greenwood cuttings under glass.

staphyleoìdes, Sieb. & Zucc. (*E. Japonica*, Dipp.). Shrub, to 10 ft.: lfts. 7–11, ovate-lanceolate, glabrous, serrate, 1½–3 in. long, each with 2 small stipules: fls. perfect, 5-merous, small, in many-fld. panicles: fr. consisting of 1–3 pods, each with 1–2 seeds. May, June. Jap. S.Z. 67.

ALFRED REHDER.

EUSTRÈPHUS (Greek, referring to the climbing habit). *Liliàceæ*. One or two Australian plants, botanically related to Lapageria, but much less showy. In habit, suggestive of smilax (*Asparagus medeoloides*). **E. latifòlius**, R. Br., is a tall, half-twining, branchy herb, more or less woody at the base, bearing alternate, stiff, linear-lanceolate, short-stalked lvs. and small, axillary, drooping light blue fls. with spreading, ciliate perianth segments: fr. a dry berry: lvs. 2–4 in. long, sharp-pointed: fls. less than 1 in. across. B.M. 1245. Of easy culture, either in the glasshouse border or in pots. Very useful for table decoration and for design work.

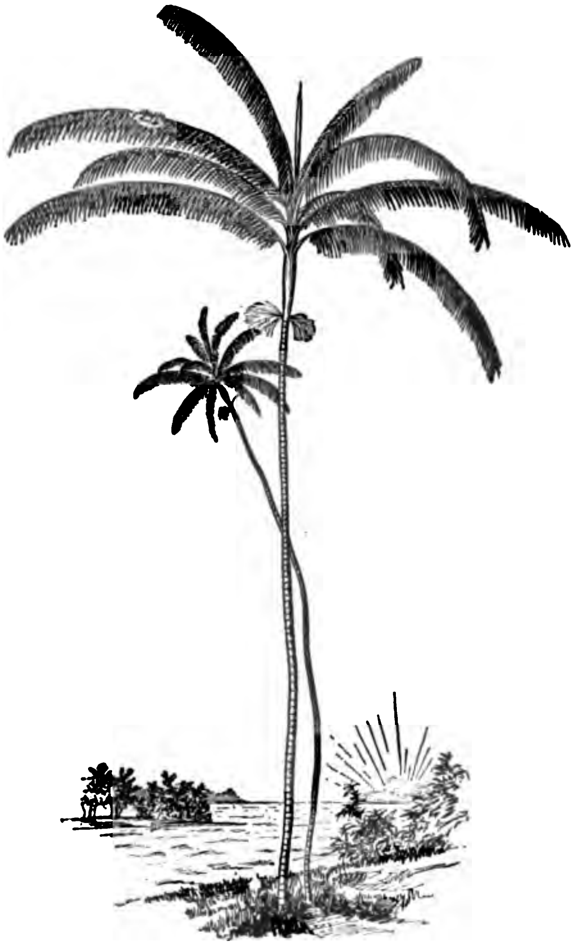
L. H. B.

EUTÁCTA. Found under *Araucaria*.

EUTÈRPE (mythological name). *Palmàceæ*, tribe *Arèceæ*. Slender, erect, spineless palms, with solitary or fasciculate, ringed caudices. Lvs. terminal, equally pinnatisect; segments narrowly linear-lanceolate, long, and gradually acuminate or ensiform, membranaceous, plicate, the thickened margins recurved at the base; rachis and petiole 3-sided toward the base, convex on the back, concave above; petiole elongated; sheath very long, cylindrical, entire: spadix paniculately branched. rachis elongated: branches slender, gradually shortening above, usually scaly, thick at the base, erect-spreading in fl.: spathes 2, coriaceous or membranaceous, lanceolate, the lower one the shorter, split at the apex, dorsally 2-keeled, the upper one symmetrical, split down the ventral side: bracts bordering the furrows; bractlets ovate-acute: fls. small, white, sessile in the furrows of the spadix: fr. like a pea, purple. Species about 8. Trop. Amer. and W. Indies.

édulis, Mast. PARA PALM. ASSAI PALM. Stem, 60–90 ft. high, 8 in. thick, flexuous: lvs. spreading; sheaths 3–4½ ft.; petiole 1½ ft.; blade 6–9 ft.; segments linear, spreading, deflexed, 60–80 on each side, densely crowded, 28–36 in. long, ¾–1 in. wide. Brazil.

oleràcea, Mast. CABBAGE PALM. Fig. 801. Stem 60–100 ft., scarcely 1 ft. in diam. at base, attenuate above, flexuous: lvs. arcuate-spreading, 4–6 ft. long, the apex more or less deflexed; segments pendent, linear-lanceolate, the upper 2 ft. long, 1 in. wide, many-nerved. Braz.—Fig. 801 is adapted from Martius' Nat. Hist. of Palms.



801. Euterpe oleracea.

montàna, R. Grah. Stem 10 ft. high, swollen at the base, ringed: lvs. 9 ft. long, elliptical-obovate; segments lanceolate, entire, glabrous, alternate; petiole 2 ft. long, scaly beneath, unarmed: rachis plano-convex below, subtriangular towards the apex. Grenada. B.M. 3874.

JARED G. SMITH.

Euterpes constitute a small group of spineless palms, said to include 8 or 10 species in all, but of these there are but 3 species commonly found in cultivation, namely: *E. edulis, E. montana* and *E. oleracea*. These are found under varying conditions in Central and South America and the West Indies, and all three species are valuable as food-producers to the natives of those countries. *E. edulis* grows in great quantities in the lowlands of Brazil, where it is known as the Assai Palm, owing to the fact that its seeds are macerated in water, and by this means is produced a beverage known as Assai. *E. oleracea* is the well-known Cabbage Palm of the West Indies, growing in the lowlands near the coast, while *E. montana* is the Mountain Cabbage Palm, and is frequently found at considerable altitudes in the same islands, and consequently does not attain the great dimensions of *E. oleracea*.

The Euterpes do not present any special cultural difficulties, being free-rooting and rapid-growing palms, a night temperature of 65° F., and abundant moisture, being among their chief requirements. A good, turfy loam, with the addition of about one-fifth of stable manure while in the compost heap, provides a suitable soil. From their habit of forming a tall, slender stem without suckering from the base, the Euterpes are liable to become rather leggy specimens. When under cultivation, and for trade purposes, it is advisable to group 3 or 4 of the young plants together, thus producing a more bushy specimen. White scale is one of the worst pests to which these palms are subject, and soon ruins the foliage unless care is taken. Seeds germinate in a few weeks if sown in a warm greenhouse, and the young plants make better progress when moderately shaded.

W. H. TAPLIN.

EUTÒCA. Now referred to *Phacelia*.

EVAPORATING OF FRUIT. While the domestic operation of drying fruit has been practiced ever since men looked beyond their immediate wants and stored food for time of greater need, and while dried fruit has long been an article of commerce, yet until a few decades ago only the most primitive methods were used in the drying process, and the industry, commercially, was confined to a few favored regions in Europe. The modern industry is scarcely more than a quarter century old. Its almost inconceivable growth in America in this brief time is one of the industrial phenomena of the epoch. Spurred into activity by the encroachments of the American product in their markets, the European producers, by the adoption of better methods, and by governmental encouragement, have increased greatly their output of dried fruit. And so, from an adjunct to fruit growing for home use, drying fruit has become, within recent years, one of the main branches of horticulture.

Fruit may be cured in the sun, or it may be cured in drying machines, called evaporators. That cured in the sun is called by the producer dried fruit; that in evaporators, evaporated fruit. By far the greater part of the world's product is cured in the sun.

Sun-drying fruit.—In countries having a sufficiently warm and dry climate, as Greece and Turkey, and parts of France, Spain and western America, fruit is dried almost wholly in the sun. The fact that in these favored localities the drying capacity is limited only by the acreage of sunshine, makes it certain that the proportion of sun-dried fruit will always be vastly greater than that of evaporated fruit. Drying fruit in the sun is a simple process, but one hedged in by many little arts and methods which facilitate the work and improve the product. In general, the process is as follows: the fruit is graded, bleached by sulfur, if a light colored product is desired, in the case of prunes dipped or pricked, and is then spread on trays to be exposed to the sun. When the drying process is finished the fruit is again graded, in most cases put through a sweat, and then "finished" in various ways, as by dipping or glossing.

Evaporating fruit.—There are hosts of styles of evaporators, but all possess in common a chamber for the reception of the fruit, through which a current of warm air is forced, or the fruit is forced through the air, or both, the object being to remove the aqueous matter from the fruit as quickly as possible, and the principle being that warm air will absorb more moisture than cool air. The saturated air must not remain in contact with the fruit. Since different fruits exact different conditions, one should be able to change the temperature and velocity of the air current in the drying chamber at will. To make the product homogeneous, current and temperature must be equal in all parts of the evaporator. It is obvious that simplicity in the machine and economy in heat and in room are cardinal virtues in a good evaporator. It is the rule to start the evaporation of large fruits at a low temperature and finish at a high one, but with berries the reverse is true. Some operators start their apples high and finish at a low temperature.

The following are definitions of the somewhat technical terms used in the industry: *Bleaching* is the process of changing the dark color of fruit to a lighter hue, or of preventing the discoloration; generally accomplished by sulfuring. *Bloaters* are prunes which in drying swell up to an abnormal size; generally produced by fermentation in over-ripe fruit. *Dipping* is the process of cutting the skin of fresh prunes to facilitate curing. The operation is performed by submerging the fruit in boiling lye. Cured fruit is sometimes dipped in one of various solutions as a "finishing" process. *Drip* is the syrupy liquid which oozes from prunes in the process of evaporation; it generally characterizes a poor prune or a poor evaporator. *Frogs* are cured prunes having an abnormal shape; a condition caused by curing unripe fruit. *Pricking* is the process of puncturing the cuticle of fresh prunes. It is done by means of a machine, the essential part of which is a board covered with projecting needles, over which the prunes must pass. It accomplishes the same end as lye dipping. *Sizes* is a term used to indicate the number of cured prunes it takes to make a pound. The "four sizes" known in the markets are 60s–70s, 70s–80s, 80s–90s, 90s–100s. *Sugaring* is the formation of globules of sugar on the cuticle of cured prunes. *Sulfuring* is a process cured fruit is put through to give it a lighter color. The fruit is subjected to fumes of burning sulfur before being exposed to the sun or put in evaporators. *Sweating* is a process cured fruit is subjected to before packing, in which it is put in a room at a high temperature and allowed to become moist.

Curing different fruits.—Apples and pears are peeled, cored, cut in rings or quarters, and sulfured, before being placed upon the drying trays. The time required for curing is about three days out of doors and six to twelve hours in the evaporator. There is considerable trade in apples called "dumplings," which are whole apples peeled and cored. Double the time is required in evaporating them, but the price is higher.

Apricots, peaches and nectarines must be fully ripe before drying and without bruises. They are pitted, and may or may not be peeled. If peeled, the operation is done with machines or with lye, though the use of the latter is considered a bad practice. The fruit is placed on the trays cup side up. About three days are required for drying in the sun and about eight hours are required for evaporating. The cured product should be of a translucent amber color.

Berries are seldom sun-dried for the markets. For evaporating they are placed on trays in quantities of from sixteen to thirty quarts, given a temperature of about 175 degrees at the start, and are finished in from four to five hours, at a temperature of about 100 degrees. After being taken from the evaporator, they are piled for sweating in a warm, ventilated room.

Figs for drying must be gathered when fully ripe. Some growers prefer drying in shade rather than in sun. Evaporators are seldom used. The fruit is not allowed to dry hard, and before packing must be well sweated. Usually, for "finishing," they are dipped in salt water or syrup. The drying process requires from five to eight days.

Prunes are allowed to ripen until they fall to the ground. Before being spread on the trays they are dipped or pricked in order to thin or crack the skin, that the moisture may easily escape, and dripping be prevented. Sun-drying requires from one to three weeks, while from sixteen to thirty hours are required for evaporation. A thorough sweat prevents the sugaring so common to this fruit. Before packing they are graded in sizes. Dipping as a "finishing" process is practiced by many producers. A good prune is soft, smooth and meaty, with loose pit, and of an amber, dark red or golden hue, depending upon the variety.

Grapes for raisins are sun-dried. They must be picked when fully ripe, the bunches, and the berries on the bunches, being sorted as the picking progresses. The operation of drying must be watched with care. The process requires from eight to fourteen days, during which time the bunches must be turned at least once. A sweat is given before packing. Raisins are graded into half a dozen or more brands for the market.

U. P. Hedrick.

EVENING PRIMROSE. See *Œnothera.*

EVERGREEN. Said of plants which do not shed all their foliage at any one time, thereby remaining green; or of leaves which persist for two or more years. In all evergreen plants, the old leaves shed after a time, when they become so overshadowed or crowded as to be of no further use to the plant. The leaves of pines and spruces persist for three to fifteen years.

In the popular mind "Evergreen" and "Conifer" are the same, but some conifers are deciduous, as the larches and taxodiums. Moreover, in the tropics most trees and shrubs are evergreen or nearly so. In the mind of the gardener, evergreen and conifer are thoroughly dissociated, and in works on gardening hundreds of greenhouse plants are called "evergreen," which represents dozens of families besides the Coniferæ. Evergreens other than conifers are sometimes called "Broad-leaved Evergreens." See *Conifers.*

EVERLASTING. A term applied to flowers or plants which retain their shape and other characteristics after being dried. Equivalent to the French word Immortelle (see Revue Horticole, 1890, p. 521).

The most important commercially of the flowers which retain their form and color in a dried state are the French Immortelles, *Helichrysum arenarium.* These flowers are used very extensively in France in their natural yellow color, for the manufacture of memorial wreaths and crosses, which, being constructed very compactly, are exceedingly durable, even in the severest weather, and are exported in large numbers to all parts of the world. The flowers bleached white, or bleached and then dyed in various colors, are also shipped in enormous quantities, either direct to this country or through some of the large exporting houses of Germany. Approaching the French Immortelles in aggregate value are the so-called Cape Flowers, *Helichrysum grandiflorum,* which have reached an enormous sale in this country within a few years, and have largely supplanted the Immortelles on account of their silvery texture and greater beauty every way. They are naturally white, but require bleaching in the sun to give them the desired luster. They come from the Cape of Good Hope, and reach this country mainly via Hamburg.

The common Everlasting of American and English country gardens, *Helichrysum bracteatum,* is the only one of these everlasting flowers grown to any extent in America, and more or less extensive cultivation of them, commercially, has been practiced in this country, but still a large percentage are imported. They come in white, straw and brown colors naturally, and take readily to a variety of artificial tints; these, together with *Ammobium alatum* and the well known Globe Amaranth, *Gomphrena globosa,* are grown and used to a considerable extent by the country folk in the construction of the many forms of wreaths, stars, and other Christmas greens, which they sell in the city markets in large quantities, but their sale by wholesalers and jobbers for general consumption is very limited. *Statice incana,* cultivated or wild from the swamps of southern Europe, and Gypsophila in several species are used to a considerable extent, and the sale of Statice especially, which is popular in combination with Cape Flowers in memorial designs, is quite an item with the dealers in florists' supplies.

Of the dried grasses, the Pampas Plumes of California, *Gynerium argenteum,* native of South America, are the only American production attaining any great commercial importance. Their beautiful silky plumes, unapproached by any other horticultural product, are used in enormous quantities for decorative purposes, and are an important item of American export. They are used mainly in sun-bleached state, but more or less dyeing, often parti-colored, is also done. *Bromus brizæformis* is the most extensively used of the smaller grasses. It is mostly imported from Europe, via Erfurt, but has been grown in considerable quantity in Michigan. It can be imported, however, including duty, for about 25 per cent less than it is possible to grow it in this country It is handled in the natural state. *Briza maxima,* another popular grass, is grown in Italy, whence it is shipped to America, Philadelphia being the largest importing port. *Briza media,* a medium sized grass, and *Briza minima,* the flowers of which are as fine as saw-dust, are also handled in the same manner as *Briza maxima*, very little of the *B. minima* being used dyed, however. *Phleum pratense*, *Stipa pennata*, and various kinds of oats have more or less commercial value, being used considerably in the manufacture of imitation flowers and straw goods, but from a florist's standpoint, they are not important. The most important commercially of the imported grasses is the Italian wheat, the quantities used in this country for the manufacture of sheaves for funeral purposes being enormous, and increasing yearly. It comes in many grades of fineness and length of stem. In this country all attempts to cultivate it in competition with the European product have failed.

Outside of wheat, it is generally true that the use of dried grasses and flowers in this country is on the decline. The fondness of our people for fresh flowers, and the abundance in which these are now offered, everywhere, at all seasons, is largely responsible for the decadence of the fancy for dried flowers. Another factor is the artificial flower industry, which, in France particularly, has attained a wonderful perfection, the materials being principally metal, porcelain, wax or cloth. In Europe, especially in Germany, the grasses seem to maintain their popularity, and it is to these foreign-born people that a large part of the material imported here goes.

A number of our native Composites—of the genera Gnaphalium, Antennaria and Anaphalis—are called Everlastings, and are often used in home decorations, particularly in the country; but they have no commercial rating. H. Bayersdorfer.

EVÒDIA (Greek, *pleasant odor*). *Rutàceæ.* Between 20 and 30 trees or shrubs of the Old World tropics, with opposite, punctate, simple or compound lvs. and small fls., in terminal or axillary cymes. Fls. unisexual; sepals and petals 4–5; stamens 4–5, inserted at the base of a cup-shaped disk; stigma 4-lobed. Warmhouse evergreens. Prop. by cuttings of half-ripened wood. **E. élegans**, Hort., from New Guinea, is a new plant resembling *Aralia elegantissima*. Lvs. prominently 3-lobed, undulate and crenate. **E. formòsa** is another new species int. 1900 by Sander & Co.

ÉXACUM (classical name, of no significance to these plants). *Gentianàceæ.* An oriental genus of about 20 species, including 3 kinds of herbs, treated either as annuals or biennials, with 5-lobed fls. of lilac, blue or dark purplish blue. Cult. in a very few greenhouses. The genus has no allies in its tribe of garden value. Herbs, dwarf and annual, or tall and paniculate-branching: lvs. sessile, clasping or short-stalked: fls. small or attaining 2 in. across, lilac, violet, blue or white, pedicelled or not, in forking cymes; calyx 4–5-parted, the segments keeled, winged or flat and 3-nerved; corolla tube short; lobes 4 or 5, ovate or oblong, twisted; stamens 4 or 5, attached to the throat, with very short filaments.

According to "K.F." in Gng. 6:229, *E. affine* can be grown in a greenhouse where the temperature ranges from 55–60° F. The showier indigo-blue *E. macranthum* requires a warmer house. The color of the fls. of *E. affine* varies according to the treatment. If kept in bright, sunny quarters they assume a bluish lilac color; in the shade, blue to deep blue. Plants flower in August. If specimens in 5-in. pots are desired, sow in March of the same year; for larger specimens, sow in August of the preceding year. The plants must be kept in a cool but not draughty greenhouse or frame in summer, and shaded from fierce sunlight. The usual precautions needed for very small seeds should be observed. They should receive their moisture from below, as overhead sprinkling disturbs the sprouting seeds.

A. *Lvs. with stalks often ½ in. long.*

affine, Balf. Stem cylindrical, 1–2 ft. high, much branched from the base: lvs. 1–1½ in. long, elliptic-ovate, faintly 3–5-nerved: sepals with a broad wing on the back; corolla 6–9 lines wide; lobes almost rounded. Socotra. B.M. 6824. A.F. 13:1104. Gng. 6:229. R.H. 1883, p. 512. Gt. 32:1108. G.C. II. 21:605.

A. *Lvs. nearly or quite stalkless.*

B. *Corolla lobes rounded.*

Zeylánicum, Roxb. Annual: stem 4-sided, branched only above: lvs. becoming 3 in. long, strongly 3-nerved, elliptic-oblong, acuminate, narrower than in *E. affine*, and tapering: fls. 1½ in. across, in terminal, leafy corymbs; sepals broadly winged; corolla lobes obovate, obtuse. Ceylon. B.M. 4423 (sky-blue, with a dash of purple). R.H. 1859, p. 238.

BB. *Corolla lobes tapering to a point.*

macránthum, Arn. (*E. Zeylánicum*, var. *macránthum*). Stem cylindrical, slightly branched: lvs. as in *E. Zeylanicum*, though perhaps more variable from base to summit: fls. 2 in. across. In both species there is a narrow ring of yellow at the mouth, to which the conspicuous clusters of stamens are attached. Ceylon. B.M. 4771 (deep purplish blue). G.C. III. 15:331.—The best of the genus. The rich, dark blue is worth striving for. Reintroduced by Sander & Co. 1899. W. M.

EXCŒCÀRIA sebífera. See *Sapium.*

EXHIBITIONS of horticultural products may be made for either of two purposes,—to illustrate the subject or thing itself, or to illustrate an ideal. As a matter of fact, all Exhibitions of domesticated products are for the latter purpose. If an Exhibit were made of what a species actually is—whether dahlia, peach or pumpkin—hostility would be aroused, for in that case the incapabilities as well as the capabilities of the plant would be shown. Exhibits are really made up of those selected forms which most nearly approach an ideal. This ideal may be a commercial one or an artistic one. The commercial ideal is likely to be held up as the only one. It is usually held dogmatically, and one who has another ideal is a heretic. A so-called show plant, as a chrysanthemum or a dahlia, may represent only one of the many possibilities of the species: and each of these possibilities may be worth the cultivating. It is a significant fact that many of the commercial types are not the most artistic or the most satisfactory ones. They are usually those which are most certain to give uniformly profitable results to the grower. The constant forcing of these types on the public attention tends to popularize them. The chrysanthemum admirably illustrates these remarks: the extra-large show blooms are less satisfactory and agreeable to most persons than freer, smaller and more individual blooms.

The Exhibition ideal in any fruit or plant has a powerful influence on the evolution of the plant. People breed for that ideal. They discard those forms which contradict the ideal. Persons who care less for the formal ideal than for variety, individuality and artistic merit are amateurs in the best sense of the word. Skilled amateurs usually deal with more varied and difficult subjects than the professionals or commercial growers. It is remarkable how plants have been bred to the Exhibition standard. The practice of carding and dressing of the carnation in earlier times has produced the high-centered, flat-bottomed carnation of today. In England, the carnation ideal has been an entire or rose-leaf petal; in America, the ideal is a moderately fringed petal. Perhaps the effect of the Exhibition ideal is nowhere so well seen as in the custom of exhibiting single blooms: it has developed the individual flower rather than the plant as a whole. The chrysanthemum, dahlia and camellia are examples. The Old World custom of showing single blooms of florists' flowers in holes in a board or in sand—like so many heads in a pillory—enforces the ideal of the single flower. Fortunately, this type of Exhibition has had little popularity in this country. A comparison of the pictures of prize Exhibition subjects in European and American journals would show some interesting contrasts. It would contrast single-flower or single-specimen ideals with bouquet ideals in florists' flowers.

In general terms, the entire plant is the unit, rather than the flower or fruit alone. The love of flowers is only the beginning of wisdom. The love of plants is a higher stage. It is pleasing that American Exhibitions are more and more given to plants and to artistic displays. The Old World Exhibitions, while emphasizing the single-flower ideal in florists' plants, are very rich in displays of specimen plants of other kinds.

Every Exhibition should make its motive or animus clear. The visitor should know whether it is the purpose to show florists' ideals, amateurs' ideals, or both. The best Exhibition of any subject is that which shows all its possibilities and merits. The tendency is for the amateur's ideals not to be seen at the shows. There are fewer prizes for these ideals, and the amateur leaves his choicest things at home. Yet the amateur is the conservator of meritorious plants. He holds interesting and artistic varieties and species decade after decade, and prevents their loss. It is the amateur who has kept the old Laciniatum chrysanthemum against the changing moods of the trade. Consider that the greater number of species described in this Cyclopedia are known only to the amateur. Our horticulture would be poor indeed if only commercial ideals should prevail.

A leading value of an Exhibition is to maintain a society. The annual or periodical show keeps alive interest in the society, and thereby enables the society to extend its beneficent work. The great displays made by the American Pomological Society, the Society of American Florists, the American Carnation Society, and other organizations, are excellent examples of the value of an Exhibition in aiding to maintain a society with educational functions. This gives a suggestion for the local improvement society: have an Exhibition in spring and fall. Invite the professional growers to show their specialties at the local show. It is well to make some one plant or group of plants a central feature of each show; and this plant should be shown in all its various forms. Endeavor to interest people in plants themselves, even though they may not show the formal ideals of the plant-breeder. Good subjects for these central features are the different fruits and vegetables, roses, carnations, chrysanthemums, dahlias, gladioli, spring bulbs, aquatics, bog plants, alpine plants, cacti, orchids, poppies, sweet peas, violets, ferns, peonies, ornamental autumn fruits, wild flowers, bloom of hardy shrubs, foliage or bloom of forest trees, and vines.

Aside from these technical uses of the Exhibition in illustrating the progress of plant-breeding, the show also may be made a powerful means of extending and deepening the love of nature. In this guise it will appeal to every person, not to horticulturists only. In every school an Exhibition once or twice a year should be made an adjunct of nature-study instruction. Such an Exhibition should not stop with plants, but include all natural objects. It should not be a technical horticultural Exhibit; and therefore, its further discussion is not germane to this work. L. H. B.

EXOCHÓRDA (from *exo*, external, and *chorde*, a cord or thong; suggested by the free placentary cords supposed to be external to the carpels). *Rosàceæ*. Hardy shrubs or small trees, remarkable for the structure of the fr., which is composed of 5 small, bony carpels, adhering around the central axis in a star-like manner. Allied to Spiræa. Prop. by seeds, cuttings and layers. Seeds are produced only on old plants; cuttings root slowly and with difficulty; layering is best. Seed propagation is advisable when seeds can be obtained.

grandiflòra, Lindl. PEARL BUSH. Fig. 802. Well known garden shrub, not often over 6–8 ft., but sometimes 15 ft.: lvs. petiolate, lanceolate-oblong, whitish below, very strong toothed on strong shoots, but almost entire upon the older parts, stipuled: fls. appear with lvs. in long, terminal racemes of 5 or 6 fls., pure white; calyx deeply 5-cleft; petals 5, narrow, roundish and clawed; stamens 10–15, short: fr. of 5 bony, 2-valved carpels joined to a common axis, each with 1 large, flat-winged seed. Apr., May. Central China. F. S. 9:954. Gt. 47:1455. R. H. 1896, pp. 324, 325. J. H. III. 34:483. B.M. 4795. A.F. 6:343. Gng. 5:97. G.C. II. 16:73; III. 7:613.— Open habit and with thin, uninteresting foliage. Individual fls. of no value. Useful only in bloom, when it is a dazzling white, the most brilliant shrub of its season. Can be kept in shape by pruning, but better back of or massed with other shrubs. Thrives in any good soil.

Álberti, Regel. Of greater vigor, darker foliage, covered with spikes of pure white fls., 8–10 on a spike. Becomes 6 ft. Turkestan. For its garden value, see Gng. for Oct. 1, 1899. A. PHELPS WYMAN.

EXORRHÌZA (*exo*, out, outside, *rhiza*, root; alluding to the large aërial roots above the ground). *Palmàceæ*. High-growing palm, with straight, smooth stem, supported at the base by large aërial, spiny roots: lvs. large, pinnate. Allied to Kentia, but distinguished by the imbricate sepals of the sterile fls., the elongated, subulate filaments of the stamens, by the roundish-ovate sepals of the pistillate fls. and by the parietal ovule. In Kentia the ovule is basal and erect.

Wendlandiàna, Becc. (*Kéntia exorrhiza*, Wendl.). Often more than 60 ft. high: lvs. 10–12 ft. long: pinnæ alternately arranged, 1–2 in. from each other, becoming 4 ft. long and 2 in. broad, 3-nerved: spadix appearing below the lvs., enveloped in thick, coriaceous, boat-shaped spathes. Fiji Islands.

802. Exochorda grandiflora. (×½.)

EXPERIMENT STATIONS exist in all the states and territories of the United States, and in the Canadian provinces, maintained by the general governments. These constitute the most extensive series of agricultural research stations in the world. In Alabama, Connecticut, New Jersey and New York there is also a station maintained in whole or in part by state funds. The total number of regular stations in the United States, to the close of the fiscal year, June 30, 1898, was 54. The total income of these stations was $1,210,921.17. In the work of administration and inquiry, these stations that year employed 669 persons, of whom 77 were horticulturists. In that year, these stations published 406 reports and bulletins. The mailing lists aggregated half a million names. Summaries of all these publications are published by the Office of Experiment Stations, Department of Agriculture, Washington, in the monthly "Experiment Station Record."

In the Dominion of Canada there are five Experimental Farms. One of these is known as the Central Experimental Farm, and is located near the capital, Ottawa, and serves the purposes of the two large provinces of Ontario and Quebec. The other four are branch Experimental Farms, sites for which have been selected in different parts of the country, as follows: One at Nappan, Nova Scotia, which serves for the three maritime provinces; a second at Brandon, Manitoba, which serves the purposes of that large prairie province; a third at Indian Head, N. W. T., which serves the purposes of the provisional districts known as the Northwest Territories of Canada; and the fourth is at Agassiz, in the coast climate of British Columbia, and meets the need of the latter important province. The grant made for the maintenance of the five Experimental Farms has been $75,000 per annum until 1899, when this was increased to $80,000. At the Central Farm there are six officers engaged in research, and two at each of the branch farms, excepting at Agassiz, B. C., where there is only one. The publications relating to the work at all the Experimental Farms are issued from the Central Farm at Ottawa.

F

FABA. See *Vicia.*

FABIÀNA (after Francisco Fabiano, Spanish botanist). *Solanàceæ.* This group is a series of surprises. It contains 16 species of heath-like shrubs from South America. They are dwarf, erect, much branched, and *E. imbricata* has lvs. suggesting an arborvitæ, being scale-like, overlapping, and densely crowded. The flowers resemble a heath in size and profusion, and their culture is the same as Erica. They belong to the same family with the potato. The fls. are club- or funnel-shaped, of 5 semi-cylindrical portions grown together at the edges and crowned by a limb of 5 short, rounded, spreading lobes. At present it seems to be cult. only in S. Calif. and the South. Abroad it is cult. under glass in winter and put outdoors in summer.

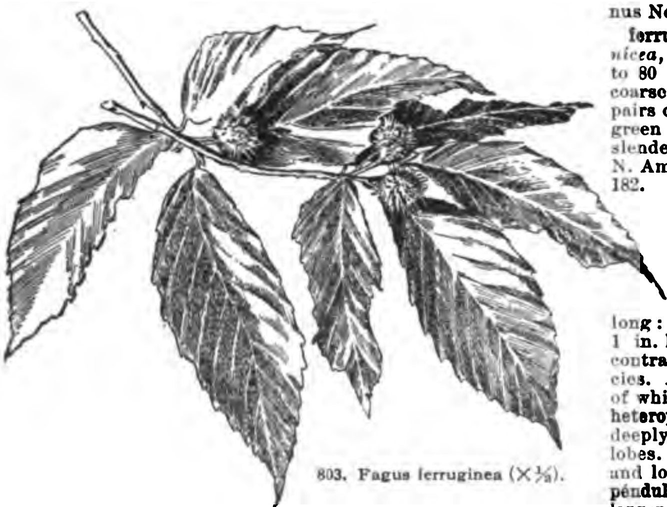
imbricàta, Ruiz & Pav. Height 3 ft.: lvs. scale-like, imbricated: fls. sessile, white. Spring. Peru. B.R. 25:59.

FAGÈLIA (after Caspar Fagelius). *Leguminòsæ.* A fast-growing, twining subshrub from S. Africa, covered with clammy hairs, and bearing all summer axillary racemes of pea-like fls. which are yellow, the keel tipped violet. Cult. outdoors in S. Calif. and abroad under glass. The plant is allied to Cajanus, but is a genus by itself, chiefly because its seeds are strophioled, pod swollen, not flattened, and the 2 upper calyx lobes nearly distinct.

bituminòsa, DC. Leaflets 3. B.R. 3:261, as Glycine, showing fls. also veined with red.

FAGOPŸRUM (*beech wheat,* from the likeness of the fruit to a beech-nut). *Polygonàceæ.* Probably only two species of Eu. and N. Asia. Quick-growing annuals, with alternate deltoid or hastate lvs., small honey-scented fls. in racemes or panicles, 5-parted calyx, 8 stamens, 1-loculed ovary ripening into a floury, 3-angled akene.

esculéntum, Mœnch. BUCKWHEAT (which see). Fig. 276, p. 186. Lvs. large and broad, long-petioled: fls. white, in panicled or corymbose racemes: akene or grain with regular angles.



803. Fagus ferruginea (X⅓).

Tatàricum, Gærtn. INDIA WHEAT. BUCKWHEAT (which see). More slender: lvs. smaller and hastate or arrow-shaped, shorter-petioled: fls. greenish or yellowish, in small, simple racemes · akene with wavy or notched angles. Useful in short-season climates and on poor soil.

L. H. B.

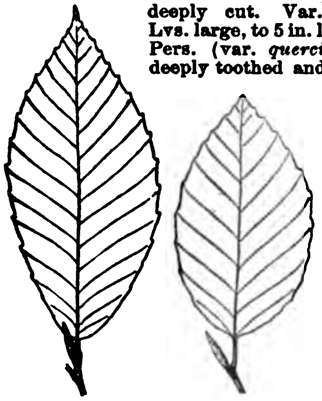
FÀGUS (ancient Latin name). *Cupuliferæ,* tribe *Fagàceæ.* BEECH. Tall, deciduous, hardy trees, of noble, symmetrical habit, with smooth, light gray bark and clean dark green foliage, which is rarely attacked by insects or fungi. They are among the most ornamental and beautiful trees for park planting, and attractive at every season, especially in spring, with the young foliage of a tender, delicate green, and the graceful, drooping heads of the staminate fls. The American and the European species are much alike, but the first has the bark of a lighter color, the head is broader and more roundish, and the lvs. less shining, but turning clear yellow in fall, while the latter has a more ovate head and shining foliage, which turns reddish brown in fall and remains on the branches almost through the whole winter. It is sometimes used for tall hedges. In Europe the Beech is a very important forest tree, and the hard and very close-grained wood is largely used in the manufacture of different articles and for fuel; but it is not very durable in the soil. The sweet nuts are edible, and in Europe an oil is pressed from them, used for cooking and other purposes. The Beech prefers dryish situations, and grows best in sandy loam and in limestone soil. Prop. by seeds sown in fall where there is no danger of them being eaten by mice, or dried after gathering and kept mixed with dry sand until spring. The young plants should be transplanted every second or third year; otherwise they make long tap-roots, and cannot always be transplanted successfully. The varieties are grafted on seedling stock, usually in the greenhouse in early spring; grafting in the open usually gives not very satisfactory results. Five species occur in the cooler regions of the northern hemisphere, all large, deciduous trees, with alternate, distichous, dentate or nearly entire lvs.: fls. monœcious, with the lvs.; staminate in slender-peduncled, pendulous heads appearing at the base of the young shoots; perianth 5–7-lobed; stamens 8–13; pistillate with 3 styles, usually two in an axillary peduncled involucre: fr. a brown. ovate, triangled nut, 1 or 2 in a prickly, dehiscent involucre. The species of the southern hemisphere, often included under Fagus (as *F. betuloides* and others), form the genus Nothofagus, which see.

ferruginea, Ait. (*F. Americàna,* Sweet. *F. atropunicea,* Sudw.). AMERICAN BEECH. Figs. 803, 804. Tree, to 80 ft., rarely 120 ft.: lvs. ovate-oblong, acuminate, coarsely serrate, silky beneath when young, with 9–14 pairs of veins, dark bluish green above, light yellowish green beneath, 2½–5 in. long: involucre covered with slender, straight or recurved prickles, ¾ in. high. E. N. Amer., west to Wis. and Texas. S.S. 9:444. Em. 182. G.F 8:125. A.G. 12:711. Var. **latifòlia,** Loud., with broader and larger, strongly toothed lvs.

sylvática, Linn. EUROPEAN BEECH. Fig. 804. Tree, to 80 ft., or rarely 100 ft.: lvs. ovate or elliptic, remotely denticulate, silky beneath and ciliate when young, with 5–9 pairs of veins, dark green and glossy above, pale beneath, 2–4 in. long: involucre with mostly upright prickles, about 1 in. high. M. and S. Europe to Caucasus. Fig. 804 contrasts the lvs. of the American and European species. A great number of varieties are in cultivation, of which the following are the most remarkable: Var. **heterophylla,** Loud. (var. *asplenifolia,* Lodd.). Lvs. deeply cut, often almost to the midrib, into narrow lobes. A very graceful variety, forming a dense and low, shrubby tree. Mn. 1, p. 61. P.G. 3:163. Var. **péndula,** Lodd. With long, pendulous branches, the larger limbs mostly horizontally spreading. Gn. 55, p. 267. G.F. 1:32. Var. **purpùrea,** Ait. (var. *atropurpurea,* Hort.). Fig. 805. Lvs. purple. A form with very dark purple lvs. and of compact habit is var. **purpùrea Rìversi,** Hort. There are other forms, differing in the shade of purple, and also some with rosy pink variagated lvs. Var. **purpùrea péndula**, Hort., has purple lvs. and pendulous branches, but is of slow growth. Var. **Zlàtia**, Spaeth, has yellow foliage. Less important varieties, but sometimes grown, are the following: Var. **cristàta**, Lodd., with deeply toothed, curled, small and clustered lvs.: of slow growth. Var. **incisa**, Hort. Similar to var. heterophylla, but lvs. less deeply cut. Var. **macrophỳlla**, Hort. Lvs. large, to 5 in. long. Var. **quercoides**, Pers. (var. *quercifolia*, Hort.). With deeply toothed and sinuate, rather narrow lvs. Var. **tortuòsa**, Hort. Dwarf form, with twisted and contòrted branches and small lvs.

F. Japónica, Maxim. Lvs. small, elliptic, crenate: involucre small, slender-peduncled, half as long as the nuts. Japan.—*F. Siéboldi*, Endl. Lvs. ovate, shortly acuminate, crenate, with 9–14 pairs of veins: lower prickles of the involucre changing into slender linear or obovate-oblong lobes. W. Asia to Japan.

ALFRED REHDER.



804. Fagus ferruginea (left), and F. sylvatica (×½).

Both in Europe and the eastern U. S. the Beech forms extensive forests. It is to-day the common hardwood tree of Central Europe, particularly in Denmark and Germany, raised as pure growth or mixture. It requires a loamy, preferably calcareous soil, shuns poor sand and swamp, ascends to 3,500 ft. in the Alps; prefers north and east exposures, endures much shade, protects and improves the soil, and produces large amounts of wood per acre. The wood is heavy (sp. gr. 0.65–0.75) hard, straight grained, of close texture, not durable. Beech is not used as building lumber, but is extensively used for ordinary wooden ware, furniture, wheelwright and cooperage stock.

F. ROTH.

FAIR MAIDS OF FRANCE. Double forms of *Ranunculus aconitifolius.*

FAIRY LILY. *Cooperia pedunculata.*

FANWORT. See *Cabomba.*

FARFUGIUM. See *Senecio Kæmpferi.*

FÁTSIA (from a Japanese name). *Araliàceæ.* This genus is doubly interesting as producing the famous rice paper of the Chinese, and two superb rivals of the castor oil plant in bold, subtropical effects, made by large lvs. which spread out like fingers. Fatsia has 3 species of trees or small shrubs belonging to the Panax series, in which the petals are valvate, while in the Aralia series they are more or less overlapping, but the sides affixed at the base. Within the Panax series, Panax itself has the pedicel articulated under the flower, while in Fatsia and Acanthopanax the pedicel is continuous with the flower. Fatsia is distinguished from the hardier and less familiar but worthy Acanthopanax by the greater length and distinctness of the styles.

While Fatsias require more care in the North than the hardy Aralias, their massive, subtropical appearance is highly distinct. A perfect specimen is figured in Gardening 5:133, where W. R. Smith says of *F. papyrifera:* "This plant produces the beautiful substance known as rice paper; it grows to 10 ft. high, with a stem 4 in. in diam., full of white pith like the elder; in a full-grown specimen the pith is about 1 in. in diam. It is divided into pieces 3 in. long, and by the aid of a sharp instrument is unrolled, forming the thin, narrow sheets known as rice paper, greatly used by the Chinese for drawing figures of plants and animals, and also for making artificial flowers. Until about 1850 the source of this substance was unknown to scientists. The Chinese, on inquiry, gave very fanciful figures and descriptions of it.

* * * It is destined to be a people's plant, as one-half inch of the root will grow and form a good plant the first season. It has survived most winters for the past five years in Washington, D. C."

As associates in groups of bold-habited plants, F. W. Burbidge (Gn. 45, p. 321) suggests *Polygonum Sachalinense, Chamærops Fortunei* and *Rodgersia podophylla.* For contrast with feathery and cut-leaved foliage, he suggests bamboos, aucubas, cut-leaved maples and various ivies. For culture of Fatsias as greenhouse plants, see *Aralia.* The two oriental species are unarmed. *F. horrida*, from western N. Amer., is a spiny plant cult. abroad. Siebert and Voss declare that most of the plants sold as *Fatsia Japonica* are *Aralia spinosa.* These plants like shade. Full sunlight for an hour or two in early morning is enough. They should have a shelter-spot, where the wind will not whip their foliage.

papyrífera, Benth. & Hook. (*Aràlia papyrífera*, Hook.). Height 5–7 ft.: branches and young lvs. covered with stellate, more or less deciduous down: mature lvs. reaching 1 ft. long, cordate, 5–7-lobed; lobes acute, serrate; sinus very deep: fls. inconspicuous, white, in sessile, globose clusters. Formosa. B.M. 4897. A.F. 7:385. Gng. 5:133. Gn. 45, p. 321.

Japónica, Decne. & Planch. (*Aràlia Japónica*, Thunb., not Hort.? *A. Sièboldii*, Hort.). Lvs. downy at first, finally shining green: fls. in umbels. Jap., China.—Abroad are cult. forms with white or golden margins and a form reticulated with gold markings.

W. M.

FEATHER GERANIUM. *Chenopodium Botrys.*

FEIJÒA Sellowiana is considered a promising fruit-plant in S. France. The frs. are about 2⅛ in. long, 2 in. thick, and 4-celled. The flesh is thick, white, pulpy and watery, with a sugary taste, resembling the pineapple and the guava, and with a strong, agreeable odor. Int. 1890 from La Plata. R.H. 1898:264. G.C. III. 24:451. Gn. 54, p. 208. Order *Myrtàceæ.*

FELÍCIA (for Herr Felix, a German official). *Compósitæ.* Much like Aster, from which it differs in having pappus bristles in one series, and in other technical characters. Forty to 50 herbs or subshrubs in Afr.

805. Good specimen of Purple Beech—Fagus sylvatica, var. purpurea.

amelloides, Voss, (*Cinerària amelloides*, Linn. *Aster rotundifòlius*, Thumb. *A. Capénsis*, Less. *Agathæa cœléstis*, Cass. *B. rotundifòlia*, Ness. *A. amelloides*, DC.). **Blue Daisy. Blue Marguerite.** Fig. 806. An old greenhouse plant, 1–2 ft., with roundish ovate opposite lvs. and large, solitary heads of an exquisite sky-blue. S. Afr. B.M. 249 (as *Cineraria amelloides*). A.F. 13:657. F.R. 1:674. Gng. 6:149.—There is a variegated-lvd. var. (I.H. 8:296). Grown easily from cuttings. Handled like a Cineraria; or, if grown from spring cuttings for winter bloom, like a Chrysanthemum, but with more heat in the fall. An elegant pot-plant, and useful for bedding in a protected place. L. H. B.

806. Blue Daisy—Felicia amelloides (× ⅓).

FENDLÈRA (after Augustus Fendler, a German naturalist, botanical explorer of New Mexico). *Saxifragàceæ*. Low, spreading shrub, with small, opposite, greyish foliage, covered in June along the slender, arching branches with graceful white fls., resembling in shape a Maltese cross. Hardy in New England, and growing best in a well-drained, sandy or peaty soil and sunny position. A very handsome and graceful plant for sunny rockeries or rocky slopes. Prop. by seeds or by greenwood cuttings under glass. One species from Texas to Mexico; allied to Philadelphus. Fls. usually solitary at the end of short lateral branchlets; calyx lobes and petals 4; stamens 8: ovary almost superior: fr. a 4-celled, dehiscent capsule, with flat, oblong seeds.

rupícola, Engelm. and Gr. To 4 ft.: lvs. linear-lanceolate or linear-oblong, 3-nerved, revolute at the margin, greyish tomentose beneath, ⅓–1 in. long: fls. milky white, 1 in. across; petals rhombic ovate, with distinct claw, spreading; stamens erect. June. G.F. 2:113. R.H. 1891, p. 42. M.D.G. 1899:231.

Alfred Rehder.

FENNEL. Species of *Fœniculum* (Umbelliferæ), annuals or treated as such, used as salad or condimental herbs. Native of S. Europe. The common Fennel (*F. officinàle*, Linn.) is grown mostly for its young lvs., which are used in flavoring, and also for its aromatic seeds. Leaves sometimes eaten raw. Sow seeds in late fall to ensure early germination in spring, or sow in early spring. In any good soil, the plant comes to maturity quickly.

The Florence or Sweet Fennel is *F. dúlce*, DC. The bases of the crowded leaf-stalks are much thickened, making a bulb-like enlargement above the ground. This thickened base has an oval form in cross-section. Earthing-up blanches these thickened leaf-bases, and after boiling they are fit for eating. A good Fennel bottom may be 3 or 4 inches high. This is an Italian vegetable, but is in the Amer. trade. Easily cultivated annual; matures quickly. Sow in spring, and later for succession.

Giant Fennel is cult. for ornament, and is described under *Ferula*. Fennel Flower is a name of Nigella.

L. H. B.

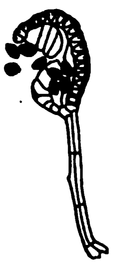
FENUGREEK (*Trigonella Fœnum-Græcum*, literally Greek hay). An annual legume indigenous to western Asia, cultivated and widely naturalized in Mediterranean countries; little grown in America. The seeds are 1 or 2 lines long, brownish yellow and marked with an oblique furrow half their length. They emit a peculiar odor, and contain starch, mucilage, a bitter extractive, a yellow coloring matter, and 6 per cent of fixed and volatile oils. As human food they are used in Egypt, mixed with wheat flour, to make bread; in India, with other condiments, to make curry powder; in Greece, either boiled or raw, as an addition to honey; in many oriental countries, to give plumpness to the female human form. The plant is used as an esculent in Hindostan; as an early fodder in Egypt, Algiers, France, and other countries bordering the Mediterranean. Formerly the seed was valued in medicine; now it is employed only in the preparation of emollient cataplasms, enemata, ointments and plasters, never internally. In veterinary practice it is still esteemed for poultices, condition powders, as a vehicle for drugs, and to diminish the nauseating and griping effects of purgatives. It is commonly used by hostlers to produce glossy coats upon their horses and to give a temporary fire and vigor; by stockmen to excite thirst and digestion in fattening animals; by manufacturers of patent stock foods as a flavoring ingredient. Fenugreek does not succeed upon clays, sands, wet or sour soils. It yields most seed upon well drained loams of medium texture and of moderate fertility; most fodder upon rich lands. For seed production, potash and phosphoric acid should be applied; for forage, nitrogenous manures. Deep plowing and thorough harrowing are essential. Ten to 20 pounds of seed should be used broadcast, or 7 to 10 pounds in drills 18 inches apart. Thinning when the plants are 2 or 3 inches tall, and clean culture throughout the season until blossoming time, are necessary for a seed crop. The crop may be mowed, dried and threshed four or five months after seeding. An average yield should be about 950 pounds an acre. As a green manure, Fenugreek is inferior to the clovers, vetches and other popular green manures of this country. It possesses the power of obtaining nitrogen from the air by means of root tubercles.

M. G. Kains.

FENZLIA. See *Gilia*

FERDINANDA eminens. See *Podachænium*.

FERN. The plants included under this name comprise an entire order, made up of several distinct families. They include plants varying in size from a hair-like, creeping stem bearing a few simple, moss-like leaves, to tall trees 40 or more feet in height, with a caudex or trunk nearly a foot in diameter. Singularly enough, the extremes in size are both found in tropical regions where most of the species abound. Most of the ordinary native species, as well as the great majority of those in cultivation, consist of an erect underground stem or rootstock with leaves, often called fronds, clustered in dense crowns, or in the cases of creeping stems with scattered leaves. The Fern plant represents the asexual phase of growth (*sporophyte*), producing its spores normally in spore cases (*sporangia*, Fig. 807), which are borne in masses (*sori*, Fig. 808) on the back or margin of the leaf, or in a few cases are grouped in spikes or panicles, or in rare cases spread in a layer over the entire under surface of the leaf. The sexual stage (*gametophyte*) develops from the germinating spore, and consists of a heart-shaped prothallus (Fig. 809), which bears the sex-organs (*archegones*, female, and *antherids*, male) on the under surface. After fertilization in the archegone, the egg develops directly into a young Fern plant (Fig. 809). Many Ferns also propagate vegetatively by runners or offsets, by bulblet-like buds, and in certain species the tips of the leaves bend over and take root, as in our common Walking-leaf (Camptosorus, which see).



807. Sporangium or spore-case of a Fern.

Great diversity has existed in the matter of the separation of the Ferns into genera. Hooker, relying mainly on artificial characters drawn largely from the sorus, recognized only about 70 genera, many of them heterogeneous groups of plants with little resemblance in structure, habit or natural affinities. John Smith, relying on stem characters, Presl on variation in venation and habit, Fée, Moore, and others, have recognized a much

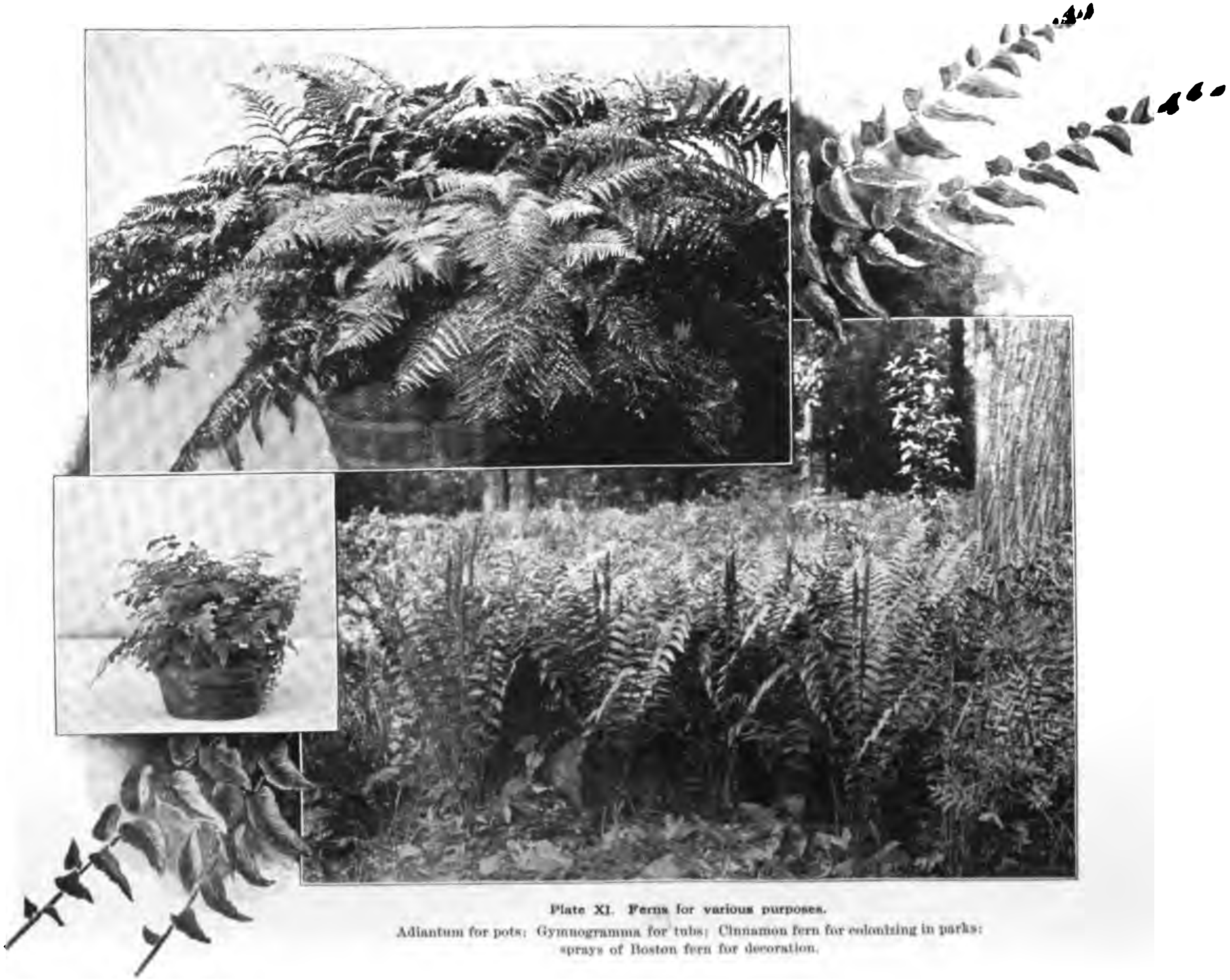
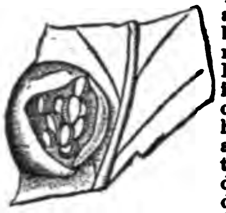


Plate XI. **Ferns for various purposes.**

Adiantum for pots; Gymnogramma for tubs; Cinnamon fern for colonizing in parks; sprays of Boston fern for decoration.

greater number of genera, ranging from 150 to 250, or even more. In the very unequal treatment by Diels in Die Natürlichen Pflanzenfamilien (Engler-Prantl), some 120 genera are recognized. A somewhat similar difference prevails in regard to the number of species. The Synopsis Filicum of Hooker and Baker (1874), supplemented by Baker's New Ferns (1892), recognizes some 2,700 species. It is the too common tendency in this work (1) to fail to recognize many valid species which have been described by German and French botanists, and (2) to mass under one name very diverse groups of species from distant quarters of the world—from 8 to 10 species not infrequently appearing as a single so-called "variable species." When we add to the number represented by these two omissions the species recently described, the number of Ferns will approximate 4,000, and possibly exceed that number. New forms are constantly coming in from the less explored parts of the world, and within the last few years several new species have been described from the United States, including some from the better known portions. Of this number some 200 species are in occasional cultivation in America, but the species that form the bulk of the Fern trade do not exceed two dozen. In Europe several hundred species have long been in cultivation. Most of the species thrive best in the insular regions of the tropics, the island of Jamaica alone furnishing 500 species and Java nearly 600. About 165 species are native in the United States, representing some 35 genera; our native species are so widely distributed that not more than from 25 to 50 will be found within the limits of one state, and the common species of the best locality do not number more than 20.



808. A sorus or fruit-dot of a Fern.

809. Prothallus of a Fern, with a young frond arising.

The Ferns belong to a group of spore-bearing plants, with vascular (woody) tissue in stem and leaves; this group is technically known as the Pteridophytes, and is composed of three orders; viz., the **Equisetales**, including the horsetails and scouring rushes; the **Lycopodiales**, including the selaginellas and the club mosses, or ground pines; and the **Filicales**, including the true Ferns and their nearer allies.

The families of the order **Filicales** may be distinguished as follows:

A. *Spores of one sort (isosporous).*

B. *Sporangia with no ring, rising from the interior tissues of the leaf. (Eusporangiate Ferns.)*

1. **Ophioglossàceæ.** ADDER'S-TONGUE FERNS. Prothallium subterranean, without chlorophyl; sporangia borne in spikes or panicles on branches distinct from the foliage leaves.

2. **Marattiàceæ.** Coarse Ferns with sporangia on the under surface of the leaf, arranged in circular or boat-shaped receptacles: prothallium above ground, green.

BB. *Sporangia rising from an epidermal cell, with an elastic ring of peculiar cells, which assist in scattering the spores by rupturing. (Leptosporangiate Ferns.)*

C. *Leaves filmy.*

3. **Hymenophyllàceæ.** FILMY FERNS. Sporangia attached to a thread-like receptacle arising in a cup at the end of the leaf: ring complete, horizontal or oblique.

CC. *Leaves more firm, herbaceous or leathery.*

D. *Ring incomplete or rudimentary: sporangia in panicles.*

4. **Osmundàceæ.** FLOWERING FERNS. Coarse swamp Ferns developing copious green spores early in the season: sporangia in panicles at the apex or middle of the leaf.

DD. *Ring apical: sporangia usually single under a scale, or in panicles.*

5. **Schizæàceæ.** Upright or climbing Ferns with ovate sporangia, which open vertically.

DDD. *Sporangia sessile, either single or united in clusters of 3–6.*

6. **Gleicheniàceæ.** Terrestrial Ferns with firm texture and usually dichotomous leaves: sporangia opening vertically, in clusters of 3–6.

7. **Ceratopteridàceæ.** Aquatic Ferns with succulent foliage: sporangia scattered, with a broad ring: leaves of two sorts, the sterile floating.

DDDD. *Sporangia numerous, collected in definite clusters (sori).*

8. **Cyatheàceæ.** Mostly tree Ferns with sessile or short-stalked sporangia in conspicuous receptacles, opening obliquely (Fig. 632).

9. **Polypodiàceæ.** Ferns with stalked sporangia (Fig. 807), which burst transversely: sori covered with a membranous indusium or sometimes naked. This family contains five-sixths of all the Ferns.

AA. *Spores of two sorts: minute microspores and conspicuous macrospores. (Heterosporous.) These spores develop into two sorts of prothalli, the microspores developing only antherids, and the macrospores only archegones.*

10. **Marsiliàceæ.** Small plants rooting in mud, the leaves either quadrifoliate or reduced to mere filamentous petioles: sporangia borne in oval conceptacles. Often aquatic, with the leaves floating on the surface of water in pools or lakes.

11. **Salviniàceæ.** Small or minute plants with the aspect of liver-worts, floating on the surface of pools: sporangia in mostly spherical conceptacles.

The literature on the Ferns is very extensive, since they have ever been attractive plants in cultivation. Many of the species have been illustrated in elaborate treatises by Schkuhr, Kunze, Hooker, Greville, Blume, Fée, Mettenius, Moore, and others. Our native species have been illustrated in the two quarto volumes of D. C. Eaton, "The Ferns of North America." A valuable summary of the more common Fern species is found in Dr. Christ's "Die Farnkräuter der Erde" (1897), and the most recent structural and morphological treatment is by Sadebeck, in Engler-Prantl: "Die Natürlichen Pflanzenfamilien." Schneider's "Book of Choice Ferns" is the most complete treatise on the species under cultivation. A useful American horticultural manual is Robinson's "Ferns in their Homes and Ours."

L. M. UNDERWOOD.

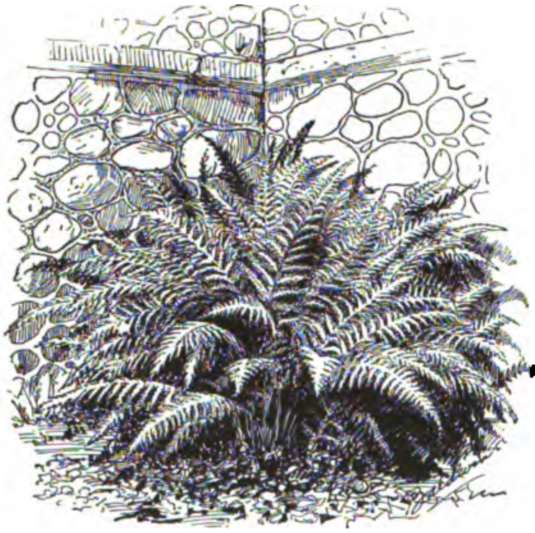
An excellent little handbook for the wild species of this country is Underwood's "Native Ferns and their Allies."

L. H. B.

GROWING HARDY FERNS.—Our hardy Ferns fill a place in our North American flora very worthy of our careful study and admiration. They seem to require so little care, and yet give such general satisfaction, and there is such a variety—suited to every taste and condition—that no one need do without them. About 20 useful native kinds are evergreen, including the Oregon Cliff-brake and *Cheilanthes vestita* of the southern states. They are very easy of culture in our New England climate. About 20, like the Maidenhair, that die down through the winter but have perennial roots, are also easy to grow. In the general cultivation of these hardy Ferns, plant them in a moist, shady situation, with good drainage, and with about one-third leaf-mold. Go to nature in selecting the Ferns. Yet it is a fact that some of these Ferns, like *Woodwardia Virginica*, found growing so common in wet swamps, will thrive in our garden soil planted with *Polypodium vulgare*, which nature plants among the rocks and on great boulders well up the mountain side, thus proving to us that it is not always necessary to plant in the same situation as we find them in the wild. As a rule, we get the best results when planted in shade, yet there are some exceptions, like Dicksonia, which is such a prominent feature on our northern New England hillsides. Many dreary places shut out from the sunlight may be beautified by a clump of Ferns, and fill the place as no other plant will do. The native kinds will survive our New England winters without covering, but they are all benefited by a mulch of leaves or boughs. Be sure that the Fern border is protected from strong winds (Fig. 810). Against the shady or half-shady side of a house is a good spot, if there is no drip from the eaves. It is best to select rather young and small clumps when hunting Ferns in the wild. When once established, these will persist and thrive for years.

It is much better to move Ferns in early spring or late autumn, when not in growth; but we may wish to plant them in summer, when they are in full growth. In this latter case cut off all the new fronds: this will retard evaporation, or keep the plant from wilting. Get the roots into the soil with as little exposure to the air as possible, and (with a very few exceptions) new fronds will spring up, giving nearly as good results as if planted in early spring. No doubt a great majority of failures from planting when in full growth are due to not cutting back.

EDWARD GILLETT.



810. Hardy Ferns against a house foundation—The Ostrich Fern.

Many species will thrive under other conditions than those in which they grow most luxuriantly in a wild state, and, in general, the species are tenacious of life wherever placed; but as the beauty of Fern foliage is brought out only by luxuriance of growth it should be the aim to plant only where such may be obtained. Ferns are exceedingly easy to transplant, and with care may be removed from native haunts during the summer, though it is always to the conservation of the strength of plants to move them when dormant. In planting Ferns, especially those of small size, the spattering of soil on the fronds by rain must be prevented by covering the earth with material such as gravel or moss for the smaller species and leaves for the more vigorous. The smaller species are easily smothered with leaves, and some of the stronger, as Dicksonia and *Aspidium Noveboracense*, do not endure coarse covering. The evergreen species should preferably be given a position shaded in winter, such as a bank with northern exposure. The best species for planting in sunlight are *Pteris aquilina*, Osmundas, Dicksonia, *Onoclea sensibilis* and *Aspidium Noveboracense*. When planting in sunlight, give a moister situation and a heavier mulch than if planting in shade. A light soil is preferable, but, except for the species with running rootstocks, is not necessary. The soil may be enriched with any manure not given to heating. For species native only of limestone soils, old plaster should be mixed with the soil. An application of any manure to Ferns growing in turf is apt to stimulate the grass to the crowding out of the Ferns.

Following are notes, drawn from experience, on the cultivation of some of the common native Ferns:

Adiantum pedatum prefers light, loose, rich soil in cool, moist shade, with yearly mulch of leaves. Soil conditions are more important than shade. Where established in a wild state will endure the full sunshine coming with the removal of trees until soil conditions change or it is crowded out by stronger plants.

Aspidium acrostichoides should be given shade both summer and winter for best results, and in no case can shade in summer be omitted. The plants will endure sunshine for a few years but will not be thrifty, and will eventually die.

Aspidium Bootti is found in a wild state in moist, shaded positions, but will grow well in shade in quite dry positions.

Aspidium cristatum prefers moist to wet soil in shade. It will not endure strong sunlight.

Aspidium Goldianum prefers deep, moist, rich soil in cool shade.

Aspidium marginale wants rich soil in rather deep shade during the entire year, but will grow well in partial shade, and endure even full sunlight, though not growing so luxuriantly.

Aspidium Noveboracense does best in rather moist, rich soil in partial shade, but will endure full sunlight with good soil conditions.

Aspidium Thelypteris prefers quite moist situations with at least partial shade.

Asplenium angustifolium thrives on rich rather moist soil in shade. Avoid complete removal of fronds when planting in early fall, as this Fern quickly sends up new fronds to the weakening of the following season's growth.

Asplenium ebeneum prefers partial shade. Care must be taken to prevent smothering by leaves and to plant where the least likely to be heaved by frost. It is found most plentifully as a native on banks growing with grass and other plants in partial shade. The fronds are evergreen, but become discolored in severe weather.

Asplenium Filix-fœmina prefers rich, moist soil in shade.

Asplenium montanum does well in continual shade.

Asplenium pinnatifidum and *A. Trichomanes* need shade during the entire year.

Camptosorus rhizophyllus in the wild state is found in cool, shaded positions not subject to excessive drought or moisture. It prefers a moist atmosphere, but this is not necessary. Avoid any covering of leaves.

Cryptogramma acrostichoides should be grown in shade. It will not endure much sun, at least not a removal to a sunny position.

Cystopteris fragilis should be planted in shade in positions where it will receive no covering of leaves. The fronds die in early August in the drier situations. It will grow in positions which become exceedingly dry in midsummer. It forces well in a coolhouse.

Dicksonia pilosiuscula prefers shady, moist situations where it does not receive any covering by falling leaves of large size. Grows well in sunshine. May be transplanted at any season, and takes kindly to heavy enrichment.

Onoclea sensibilis prefers a rich, moist soil in partial shade or full sunshine. It will also grow in shade.

Onoclea Struthiopteris should be given a rich, moist soil with at least partial shade. The fronds will "burn" in fierce sunlight.

Osmunda cinnamomea prefers moist, partially shaded situations, but will grow well in full sunshine in rich soil not exceedingly dry.

Osmunda Claytoniana, a native of low ground, both in shade and sunshine, but will grow equally well in rich soil only fairly moist.

Osmunda regalis prefers a peaty soil in very wet, boggy position in partial shade, but will grow as well in full sunshine if soil is rich and not dry.

Pellæa atropurpurea prefers rather dry positions in partial shade, winter and summer, with soil not deficient in lime. It will not endure heavy mulching. Will grow in full sunshine, but not to its full size. It may be transplanted at any season.

Phegopteris Dryopteris prefers good soil in shade not over moist or dry. Avoid coating of leaves. It is a beautiful species and useful for planting on rockwork in shade. The fronds die in August.

Phegopteris hexagonoptera needs good soil in shade. Fronds die down rather early.

Phegopteris polypodioides prefers moist, shaded positions, but will grow in any good soil not too dry. The fronds die down in late summer, especially in the drier positions.

Polypodium vulgare prefers good, light soil in well drained but moist situations in shade, with no other plants growing with it. It will endure very dry places, but will be dwarfed. Will also do well in full sunlight if soil conditions are good. As a native it grows in positions where it does not receive any yearly coating of fallen leaves, and, wherever planted, should not be covered with coarse material. Plant perfectly evergreen; height 6–10 in.

Pteris aquilina, to be grown to perfection, should have considerable sunlight, with moist, rich soil, kept cool and loose with a coating of leaves or other material. In such a position it should grow 4–5 ft. high, with other dimensions corresponding. However, it will grow in almost any position. Although easy to transplant, it is likely to do poorly until established. It has strong, creeping rootstocks, so that attention is necessary to keep a healthy group within bounds. The earliest fronds put forth die in late summer, but those of later growth remain green until frost, so that with attention to the removal of dead fronds a group will look well until fall.

Woodwardia angustifolia wants a moist situation in deep shade. Does well in moist peat north of a bank or wall. Will endure full sunlight in positions where it has become established, but will not grow well when transplanted to sunny position. F. W. BARCLAY.

CULTURE OF TENDER FERNS.—To grow commercial varieties of Ferns profitably, the first care should be to secure the necessary number of properly built and equipped houses, with a conveniently arranged workshop. The house which gives the most general satisfaction runs north and south. Have an even-span roof, with a fall to roof of 6 inches to the foot. Its benches should be arranged to be about 7 feet wide, with a 24-inch path on either side. In an 18-foot house this will permit of having a 7-foot center table, two 3½-foot side benches and two 24-inch paths. Benches should not be more than 3 feet above the walks, as this will bring every part of the bench within easy reach, and will permit of every plant being in constant sight and easily cared for, which fact is essential in the profitable cultivation of trade Ferns.

The width of house is immaterial, but when houses adjoin, a width of 27 feet has been found to be very satisfactory, as this permits the construction of three 7-foot benches, two 24-inch paths, and two paths 2½ feet wide under each gutter.

Thorough provision should be made for ventilation. For a 27-foot house, a continuous row of ventilators of at least 3 feet in width should be provided, with some reliable apparatus for raising same. Heating is the next important consideration. Either steam or hot water will give equally good results if properly installed. The safest way for the average grower is to give the heating contract to some reliable firm. Water taps should be so arranged that a 25-foot hose attached to same will easily reach any part of the house. A 25-foot hose can easily be carried about without injuring either itself or benches and plants; and iron pipe is of only half the cost of good hose. In most Fern houses drip is a source of great annoyance, and should be prevented by the use of drip-bars, by having a drip-groove plowed into the headers immediately under the ventilating sash, and also by having a groove in sides of gutter plates. This very slight additional expense will very soon pay for itself by saving a great number of plants, especially when growing very small Ferns in houses, such as have been transplanted from spore-pots into boxes. Ventilators should fit into a groove in ridge of house and be hinged to the ridge. When ventilators are so arranged, air, which is very desirable on a good many warm, rainy days in the summer, can be given without having plants in the houses suffering from excessive moisture. Burning of the foliage will also be avoided, as the plants will at no time be exposed to the direct rays of the sun. Ventilators hinged on header and opening on ridge will always give trouble. No matter what kind of covering is put over the opening, if it efficiently excludes the burning sun's rays it will also prevent the ingress of air.

Propagating room should be provided for ; and in the case of general trade Ferns raised from spores, it is a very safe rule to calculate on having from 60 to 70 square inches of room in the propagating frame for every 1,000 plants desired. The propagating frame should be 3½ feet wide, have sides 9 inches high, and, to insure an even moisture, its bottom should be covered to the thickness of 1 inch with fine cinders with the fine ashes removed, which make very clean and efficient drainage material. The frame should be covered with light sash constructed with drip-bars, to carry off condensation.

Shading of Fern houses should have close attention. It is best effected by the application of a suitable wash to the outside of glass on roof. The following composition for a wash has given excellent results for a number of years: To 2 gallons of benzine or turpentine add 1 pint (or more, according to time the shading is desired to remain on houses) of linseed oil, 5 pounds of pure white lead and enough whitening to make proper thickness (which can very easily be ascertained by applying some of it to a piece of glass while adding the whitening); thoroughly mix and apply to outside of glass with a soft brush of the same width as glass. This shading, by the addition of more or less linseed oil, may be made to stay on houses up to one year. If properly applied in spring, it will be just right during the hot days of summer, and in the fall and winter, when more light is gradually required, the frosts gradually will have reduced the shading, thus admitting more light at the necessary time.

Much time, annoyance and expense will be saved by a careful arrangement of the workshop, or potting room, a thing which in most cases is totally neglected. It should be so built that potting benches are about 3 feet above the floor and 5 feet wide. They may be permanently constructed of substantial material, in order that a number of pots of different sizes can be conveniently stored, and that potting material can be thrown from cart or wagon directly onto potting benches. By an improper arrangement of workshop great expense, loss of time and material are incurred by having to handle material repeatedly in small quantities.

Propagation by Means of Spores.—To grow Ferns from spores successfully, it is advisable to sterilize soil on which spores are to be sown, which can best be done by subjecting it to a high temperature by means of steam under a pressure of from 10 to 15 pounds; and for this purpose a properly equipped workshop should be provided with a tight box about 3 by 3 by 8 feet or larger if an uncommonly large number of Ferns is to be grown. It should be fitted with a grating made of 2-inch laths spaced one inch apart and placed 2 inches from bottom of the box. This grating may be covered with burlap, and if a ¾-inch steam pipe is fitted between bottom of box and grating, and connected to highest point of steam boiler (to insure getting perfectly dry steam) we are ready to sterilize the soil. After having cooled off, the soil is in practically the same condition as before as far as moisture, friableness, etc., are concerned, and this cannot be said of soil that has been sterilized by burning and by other methods. This steaming process will effectually destroy all forms of life in the soil and leave it for the use of spores alone. In most localities, the water used for moistening spores is impure and full of the spores of low forms of plant life, which are very destructive to the prothalli of Ferns. To prevent this, the workshop should be provided with a receptacle in which the water intended for use on Ferns while in the prothallus state can be raised to a boiling temperature, which will effectually destroy all spores that may be present in the water. This is best done by leading a 1-inch steam pipe to within 6 inches of the bottom of the receptacle and turning on a reasonable pressure of steam. If boiled 12 hours before intended for use, it will be cool enough to be applied, and will be pure. A Fern workshop should also be provided with a dry closet, having a number of shelves about 12 inches apart, for storing Fern spores.

In beginning the cultivation of Ferns, it is advisable to purchase the spores from some reliable firm which makes Fern-growing a specialty, until a sufficient number of stock plants can be grown to supply spores for home demand. Spores will do about equally well in pots or pans. Pans 12 inches square and 4 inches deep are used for that purpose, as also are the 6-inch common flower pots. The 12-inch pans should be supplied with 1⅛ inches and the 6-inch pots with 3 inches of coal cinders for drainage. Soil for sowing spores on is best composed of five parts, in the proportions of two parts good garden soil, two parts of finely screened peat and one of sharp, clean propagating sand. Leaf-mold may be used instead of peat, if easier to procure. This soil should be thoroughly sterilized, as already directed. The spore pots should be filled with the soil to within ¼-inch of the top; press firmly. The rest of the pots should be filled with the same composition after it has been passed through a screen of about ⅛-inch mesh, then made absolutely level, firmly pressed and thoroughly watered with sterilized water. Three or four hours after watering will be the best time to sow spores. The spores should be thinly scattered over the surface of the soil, a quantity that can be held on a surface of one-fourth of a square inch being abundant to sow one 12-inch pan. Spores should not be covered with soil. Immediately after sowing, the sash of the propagating frame should be tightly closed and kept so until spores show signs of germination, when a small quantity of air should be given and gradually increased, so that by the time the first small fronds have made their appearance they may have been sufficiently hardened off to have the sash removed entirely. In sowing spores, great care will be necessary to prevent them from getting mixed, Fern spores being very minute and so light that the slightest movement of air will carry them long distances. While sowing spores, all spore pots should be kept tightly covered. Being kept in a very close and humid atmosphere after sowing, the spores should not require any watering for one or two weeks, by which time they will have sufficiently settled not to be dislodged by a very gentle overhead watering, which should be given whenever soil shows the least sign of being dry. Sterilized water should be used until after the first fronds have been formed. As soon as the first little fronds have made their appearance, care should be taken to weed out all undesirable varieties, which, even with the very best of care, will occasionally creep in. A temperature of 65° F. should be maintained in the propagating house.

811. A Fern pan.

As soon as the first little fronds are evenly formed all over the surface of the pot, the little plants should be transferred in clumps of four or five plants each, to well drained pans (Fig. 811) or boxes filled with soil composed of one-half rich garden soil and one-half peat or leaf-mold, finely screened. In transplanting, great care should be exercised not to cover the remaining prothalli, but to have them just level with the surface of the soil. The clumps of plants should be kept as loose as possible, as this will give each individual plantlet a better chance to form the necessary number of rootlets, and it will, later on, also be easier to separate the plants. Boxes for transplanting Ferns are most convenient when 4 inches deep, 14 inches wide and 22 inches long. These boxes will hold about 200 plants placed about one inch apart. As soon as the little plants have formed two or three fronds each, they should be separated and transplanted singly into boxes similarly prepared as before, where they may remain until sufficiently strong to be potted into 2- or 2¼-inch pots.

Times of sowing Fern spores are the first weeks of March, July and October. When making three sowings a year, and allowing a sufficiently longer time for slower growing varieties, a constant supply of plants will be assured. In calculating on time of sowing spores of commercial varieties of Ferns, it will be helpful to divide them into two classes, as some varieties are considerably slower of growth and will consequently have to be sown earlier, in order to be ready for sale at the same time as the more rapid-growing ones. The following popular commercial varieties will require from 9 to 10 months between times of sowing and potting. The names are those which the plants bear in the trade:

Adiantum cuneatum,
" " variegatum,
" " grandiceps,
" Bausei,
" decorum,
" Fergusonii,
" gracillimum,
" mundulum,
" tenerum,
" Wiegandii,
Cibotium Schiedii,
" regale,
Cyathea medullaris,
Cyrtomium caryotoideum,
" Fortunii,
" falcatum,
Davallia tenuifolia stricta,
" " Veitchiana,
Dicksonia (Balantium) antarctica,
Doodia aspera,
Doodia aspera multifida,
" caudata,
Doryopteris nobilis
Lastrea aristata,
" " variegata,
" chrysoloba,
" opaca,
" Sieboldii,
Lygodium Japonicum,
" scandens,
Nephrodium hirtipes,
Nephrolepis exaltata,
" cordata compacta,
Platyloma Bridgesii,
" falcata,
Polypodium aureum,
" fraxinifolium, etc.,
Polystichum coriaceum,
" setosum,
Pteris Victoriæ,
" Tremula Smithiana.

The following trade varieties will develop into plants large enough to be potted in about six months after sowing spores:

Adiantum pubescens,
" hispidulum,
Alsophila australis,
Gymnogramma calomelanos,
" chrysophylla,
" decomposita,
" Peruviana,
" sulphurea,
Lomaria ciliata,
" gibba,
" " platyptera,
Nephrodium immersum cristatum,
Nephrodium molle corymbiferum,
Onychium Japonicum,
Pteris argyræa,
" Cretica albo-lineata,
" " magnifica,
" " Mayii,
" " nobilis,
" hastata,
" " adiantoides,
" internata,
" Sieboldii,
" leptophylla,
" Ouvrardii,
" palmata,
" serrulata,
" " cristata,
" " " nana,
" Tremula,
" Wimsettii.

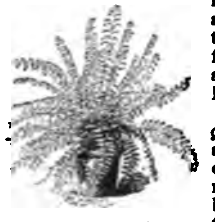
It should also be borne in mind, when calculating time of sowing, that spores sown in the autumn will require about four weeks longer for development than those sown at other times of the year.

Fern spores are borne on the back or under side of fronds. In some cases they are borne naked on under surface of frond, while in others they are produced under a scale-like membrane or indusium. In some cases, as in Pteris, the edge of the pinnæ is folded back over the spores, while in Adiantums a small part of the leaflet is folded back over each little fruit-dot to serve as a shield or indusium. Davallias form a small sack-like receptacle at the extremity of the pinnæ. The proper time of gathering spores is when they assume a light brown, rather dry appearance, or in the indusium-bearing kinds when the indusium or shield begins to open. Spores should be gathered on a dark day when the fronds are slightly moist, as they will be better retained in that condition, and will not be so liable to get mixed when disturbed. Fronds, or parts of them, should be cut off entirely in most cases, put up in tight paper bags and stored on shelves in a dry closet for a week, by which time, in most cases, they will be sufficiently dry to have spores removed from them by rubbing the frond in a sieve which has about 20 meshes to the inch. When thus separated from fronds the spores should be put up in small seed-bags and placed in air-tight jars until required for sowing. Cared for in this manner, perfect success has been invariably secured, even after keeping spores for years.

Propagation by Other Means.—Some Ferns form little plants at the ends of pinnæ and of fronds, which upon attaining to sufficient size may be detached from parent plants, planted into shallow, well-drained seed-pans, and for a week or two left in the propagating frame, where they will soon form roots, when they can be potted. Among such are *Adiantum caudatum*, *A. Edgeworthii*, *A. lunulatum*, var. *dolabriforme*, *Asplenium Belangerii*, *A. bulbiferum*, *A. salicifolium*, *Gymnogramma schizophylla*, var. *gloriosa*, *Polystichum angulare*, var. *proliferum*, and many more.

A very useful decorative Fern is *Nephrolepis davallioides*, var. *furcans*, and it will make a beautiful specimen plant in a comparatively short time. To grow large quantities, the old plants should be cut back to within 6 inches of surface of soil and placed in a house where a bottom heat of 90° F. may be secured, when they will soon form a large number of short, strong fronds. At this time they may be divided into a number of small plants, potted off and placed in the same position as the parent plants. A somewhat slower method is to plant out a number of plants on a bench into 5 inches of soil, in which soil the rhizomes, running over the surface, will form a number of small plants, which may be detached and grown on.

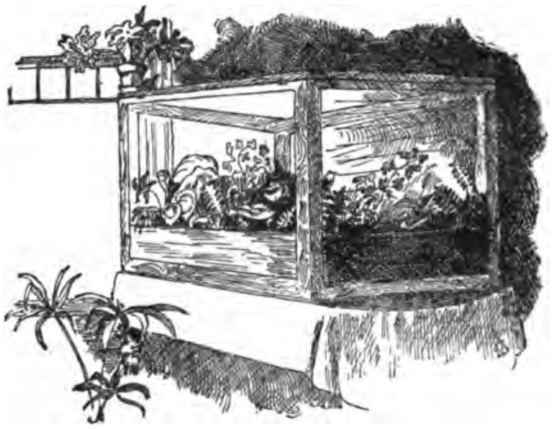
A beautiful Fern is *Adiantum Farleyense*, and it deservedly ranks as the greatest favorite among Fern-lovers. It is best propagated by division. From old plants, cut off all fronds down to the rhizomes, wash off soil, cut rhizomes into pieces ¼-inch long, insert same into well-drained Fern boxes about ¼-inch apart, in 1¼ inches of clean, sharp propagating sand. Place same in propagating frame in a temperature of 70° F. In this position each little fragment of rhizome will form two or three little fronds in about 15 or 20 days, when they may be potted off singly into 2-inch pots and kept in a temperature of 70° F. The soil best adapted to *A. Farleyense* is finely chopped sod which has been piled for about six months, with one-fifth well decomposed cow manure added. To attain perfection in growth and coloring, *A. Farleyense* should be kept in a light, airy and sunny house, in which every condition of moisture and atmosphere can be kept under absolute control. In a house of this kind, the greatly admired and beautifully pinkish tint may be easily obtained and fronds will be hardy and of good substance. A temperature of 70° F. is at all times desirable.



812. A good specimen.

General Remarks on Fern-growing.—To grow Ferns such as are used for jardinieres and decorative work (Fig. 812), and mentioned in the two preceding lists, a temperature of no less than 55° F. should be maintained at all times at night in coldest weather, with a rise of temperature in the daytime of 10 or 15°. To keep Ferns in a healthy and growing condition, to prevent and to kill insect pests and diseases, a proper condition of atmosphere should be carefully maintained at all times. Extremes in heat, moisture or dryness should never be allowed. On a warm, dry, sunny day, when a great deal of air has to be admitted, much of the moisture of the house is consequently carried off; it will be of great benefit then to syringe the Ferns once or twice a day, also to occasionally dampen floor of houses. An excessively dry atmosphere induces the development of the very troublesome pests, thrips and red spider. On damp and rainy days a saturated atmosphere should be prevented by supplying a little artificial heat, even if some air has to be admitted at the same time. This slight expense of heating on damp days will abundantly pay for itself by causing the growth of strong, thrifty plants. An excessively moist atmosphere causes parts of fronds of a great many plants to turn black and to rot off, besides inducing the development of almost incurable fungoid diseases.

In the selection and growing of stock plants, the careful grower should always be on the watch for types which are most perfect in shape, in character of individual fronds, in coloring, freedom of producing spores, and exemption from the attacks of insects and fungous diseases. In a large number of Ferns a great difference between the different plants of the same species will be apparent to the careful observer. Some plants of same species have beautifully developed fronds, but are carried on long, weak stems, which makes them unfit for general use. Others may be of compact, sturdy habit of growth, but with poorly shaped individual fronds. In some individuals the coloring will be greatly superior. By closely studying all these points and by continually selecting only the most perfect types of Ferns from the young plants, we can in a few years work up a very desirable and superior stock. The same stock plants of the rapid-growing varieties of Ferns should not be carried over for more than three or four years, but young and more desirable plants should continually be selected and grown to take their places.



813. A home-made Fern case.

The stock should be shifted into larger pots whenever necessary, and placed in a light, airy house, in which all necessary conditions are under perfect control, and in which a temperature in coldest weather of 55° F. at night, with a rise of 10 or 15° in daytime, can always be maintained. The house should be shaded just enough to prevent fronds from turning yellow. Proper attention to atmospheric conditions of stock-house should never be neglected. Stock plants should not be permitted to remain pot-bound for too long a period of time, except with a few varieties, such, for instance, as Alsophilas, Dicksonias, Cyatheas, Ciboiums, *Pteris Tremula*, *P. argyreæa*, some Davallias, *Polystichum coriaceum*, etc., which, if given too much nourishment, will often be very slow in setting spores.

Insects which are most troublesome to Ferns are thrips, red spider, scale and mealy bug. They are mainly present in a too dry atmosphere. Thrips, red spider and mealy bug are easily prevented by a properly moistened atmosphere, also by spraying of foliage once a week with tobacco water. As tobacco greatly varies in strength, every grower will have to determine to his own satisfaction how strong to make his solution. The preparation known as "Rose-leaf tobacco extract," has proved very efficient in destroying these insect pests. To 50 gallons of water add one quart of the extract, and apply with some good insecticide sprayer and a force pump. Fifty gallons of this solution will be enough to spray 100,000 Ferns in 2¼-inch pots.

Bearing in mind the foregoing advice, the amateur Fern-grower may determine the proper way in which to raise his plants. He may not have a Fern house, but he can have a tight glass box or Wardian case (Fig. 813).

The bottom should be a zinc tray, to prevent drip on the floor and to prevent too rapid drying out of the soil. The top or roof of the box should be hinged, so that it can be raised. In this miniature greenhouse many interesting Ferns can be grown. Lycopodiums and Selaginellas (which see) are treated in much the same way as Ferns. Nichol N. Bruckner.

Growing Ferns from Spores by the Amateur.—Ferns may be raised from spores at almost any season of the year, though the early spring months are best. The shallow pans 2 in. deep by 6 in diameter, now sold by pot manufacturers, we have found, after repeated trials, best to sow Fern spores in. These should be filled to within half an inch of the top with a mixture of sifted peat, leaf-mold and silver sand in equal proportions, the surface being made very fine and even. By sowing the spores thinly we have found that they are not as liable to the attacks of fungus during the prothallus stage. They should not be covered with soil, as in sowing seeds. Each pan should be placed in a pot-saucer, and all the water necessary to keep the soil moist should be poured into the saucer and allowed to soak up through the soil. This not only prevents the spores being floated into clusters, but probably filters the water of any germs of low forms of vegetable life which might prove injurious to the spores during germination. After the prothallus stage is passed this precaution is unnecessary; as soon as the young Ferns begin to develop fronds, they may be watered freely overhead with a fine rose. The pans should be placed in a temperature of 65° to 75°, in a shaded position. Each pan should be covered with a pane of glass to keep the surface evenly moist, taking care to remove the moisture which collects on the glass at least twice daily; but as soon as the spores have germinated, which, in most cases will be in about ten days, these should be gradually removed. A close watch must be kept for fungus during the prothallus stage, and if a pan should show the least sign of it, it should at once be isolated from the rest and a little fine sulphur dusted upon it; if this fails to check it the prothalli should be at once transplanted to fresh pans of soil, which usually checks it. The chief reasons for fungus are sowing the spores too thickly, a too stagnant atmosphere after germination, and a dripping greenhouse roof. As soon as the young Ferns begin to make fronds, they may be transplanted. Edward J. Canning.

FERN BALLS are the dried rhizomes of Ferns, imported from Japan. Dealers start them into growth, and sell them when the mass is well covered with its delicate vegetation. To start them into growth, the balls are drenched in a tub of water and then hung in a warmhouse, not in direct sunlight. When the plants are well started, gradually expose them to more light and to a cooler air. Give liquid manure if they do not grow satisfactorily. The species are mostly Davallias, oftenest apparently *D. bullata* and *D. Mariesii*. L. H. B.

FERNS, POPULAR NAMES OF. **Adder's Tongue F.**, *Ophioglossum vulgatum*. **Beech F.**, *Phegopteris*. **Bird's-nest F.**, *Thamnopteris Nidus-Avis*. **Bladder F.**, *Cystopteris*. **Boston F.**, *Nephrolepis exaltata*, var. *Bostoniensis*. **Bristle F.**, *Trichomanes*. **Buckler F.**, *Dryopteris*. **Californian Gold F.**, *Gymnogramma triangularis*. **Chain F.**, *Woodwardia*. **Christmas F.**, *Polystichum acrostichoides*. **Cinnamon F.**, *Osmunda cinnamomea*. **Climbing F.**, *Lygodium*. **Deer F.**, *Lomaria*. **Elk's Horn F.**, *Platycerium alcicorne*. **Female F.**, *Asplenium Filix-fœmina*. **Filmy F.**, *Hymenophyllum*. **Floating F.**, *Ceratopteris*. **Flowering F.**, *Osmunda;* sometimes also *Anemia*. **Gold F.**, *Gymnogramma*. **Grape F.**, *Botrychium*. **Hart's-tongue F.**, *Phyllitis Scolopendrium*. **Hartford F.**, *Lygodium palmatum*. **Holly F.**, *Polystichum Lonchitis*. **Lace F.**, *Cheilanthes gracillima*. **Lady F.**, *Asplenium Filix-fœmina*. **Lip F.**, *Cheilanthes*. **Maidenhair F.**, *Adiantum;* more particularly *A. Capillus-Veneris* abroad and *A. pedatum* at home. **Male F.**, *Dryopteris Filix-mas*. **Marsh F.**, *Dryopteris Thelypteris*. **Oak F.**, *Phegopteris Dryopteris*. **Ostrich F.**, *Matteuccia Struthiopteris*. **Pod F.**, *Ceratopteris thalictroides*. **Rattlesnake F.**, *Botrychium Virginianum*. **Royal F.**, *Osmunda regalis*. **Sensitive F.**, *Onoclea sensibilis*. **Shield F.**, *Dryopteris*. **Stag-horn F.** See *Platycerium*. **Sun F.**, *Phegopteris*. **Sweet F.**, *Myrica asplenifolia;* abroad, various *Dryopteris*. **Sword F.**, *Nephrolepis exaltata*. **Venus' Hair F.**, *Adiantum Capillus-Veneris*. **Walking F.**, *Camptosorus rhizophyllus*. **Wall F.**, *Polypodium vulgare*. **Wall-rue**, *Asplenium Ruta-muraria*. **Washington F.**, *Nephrolepis exaltata*, var. *Washingtoniensis*.

FERRÀRIA (Giovanni Battisti Ferrari, 1584–1653, Italian Jesuit, botanical writer and collaborator with the celebrated artist Guide Reni). *Iridàceæ*. There are 7 species, all from the Cape of Good Hope, rarely growing more than 6 in. high. They have a large, irregular corm and very glaucous foliage, the lowest lvs. being long and linear, the rest ovate, clasping, successively smaller, and topped by inflated sheaths from which emerge the oddest fls. imaginable. These have 6 triangular, spreading, crisped, petal-like lobes, wonderfully marked with many dull colors, as yellow, green, purple and brown. Each spathe contains several fls., and the fls. are united at the very base, connivent and cup-shaped below the spreading lobes. The fls. last only from morning to afternoon of a single day, but there is a fair succession. Some are visited by carrion flies. Only one species, *F. undulata*, is advertised at present, but the other 6 are doubtless of equal interest. The first is the oldest kind in cult. It was known to pre-Linnæan authors as *Flos Indicus* and *Gladiolus Indicus*. E. S. Miller writes that the bulbs should be stored like Gladiolus in a dry, warm place, away from mice.

A. *Fls. dull brownish purple.*

undulàta, Linn. Stem stout, erect: upper lvs. and spathes 1⅛–2 in. long: fls. 2 in. across, largely dull purple; anthers oblong, with parallel cells. B.M. 144.

AA. *Fls, greenish.*

uncinàta, Sweet. Lvs. 2–3, linear: fls. 2, "cream colored, edged with sage green," according to W. E. Endicott.

AAA. *Fls. dark purple.*

stràta, Lodd. Lvs. about 4, sword shaped: fls. 3–4.

Other names are advertised by Dutch bulb growers, but are not to be found in Index Kewensis or Flora Capensis: *F. Canariensis*, *cœlestis*, *Conchiflora*, *grandiflora*, *immaculata*, *liliacea* and *rosea*. These can perhaps be accounted for under Tigridia, where *F. Pavonia* belongs. W. M.

FERTILITY of soils: that condition of soils which makes them productive. The elements of productivity are, a full supply of available plant-food, a suitable and continuous supply of moisture, good physical conditions of the soil, coupled with suitable seed and climate.

Land may contain vast quantities of potential nitrogen, potash and phosphoric acid and other plant-food, and yet be unfruitful,—infertile. Most of the potential plant-food in the soil is lazy, not available in sufficient quantities in a single season to produce maximum crops. Average arable land which contains from 3,000–4,000 pounds of nitrogen, an equal amount of phosphoric acid and four times as much potash in the first 8 inches of an acre, may produce only 15 bushels of wheat per acre, which requires, with the straw, but 24, 13 and 20 pounds of these three elements respectively. Therefore, land may contain a great abundance of potential plant-food and yet not contain enough of that which is available for a full crop. To make land more fertile, one or more of the following means may be employed. Usually deeper and more thorough tillage should first be resorted to, since most lands, by reason of careless farming, contain much inert plant-food. Superior tillage is almost certain to produce fruitfulness, and therefore should be resorted to before more expensive methods are tried. Tillage not only makes plant-food more available, but it improves the physical conditions of the soil, thereby making it more comfortable for the plant; it may also assist in relieving the land of surplus water, and give to the soil the power of retaining large stores of moisture by capillary action.

Moisture plays such an important part in productiveness that it may be said to constitute its prime factor. Clay soils are usually composed of such fine particles that water percolates through them slowly or not at all. The rainfall then must either run off over the surface, or remain to be evaporated. The aim should be to so prepare the land by subdrainage, plowing and surface tillage, and by introducing at least one crop of tap-rooted plants in the rotation, that the surplus water will filter through the soil in a reasonable time. Percolation of rainwater through soils makes them more friable and warmer in spring, aërates the land, promotes beneficial biological and chemical changes, and brings to the soil the nitrogenous compounds contained in the rainwater. Soils which are reasonably porous have the power of retaining more moisture, and of giving it up to plants when needed to a greater extent, than either open sandy or close clay soils do. Fertility, which results in fruitfulness, is governed very largely by the water and moisture conditions of the soil, and these, in turn, are largely governed by the texture of the land and the amount of humus which it contains.

Legumes, used either as a harvest or cover-crop, promote fertility. A cover-crop of clovers planted August 1, and analyzed 64 days after planting, contained of nitrogen, in roots and tops, per acre as follows:

	Tops Lbs.	*Roots* Lbs.	*Total* Lbs.
Crimson clover............	125	30	155
Red clover..................	63	40	103
Mammoth clover..........	67	78	145

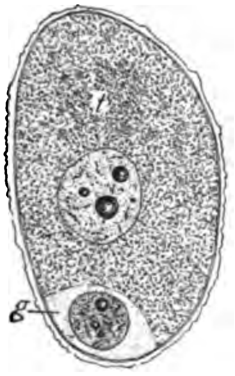
Clovers and other legumes may be used to fix and store up the uncombined nitrogen of the air and to digest and make available the mineral constituents of the land, thereby greatly increasing the fertility of the soil.

Barn manures, when properly cared for and intelligently applied, not only furnish acceptable plant-food but humus as well. Fertility and high productivity usually may be maintained many years by means of superior tillage, leguminous harvest and cover-crops, and the manures of the farm. In some cases a high state of fertility can be maintained only by occasional applications of commercial mineral fertilizers, as phosphates and potash, but too often expensive fertilizers have been substituted for tillage, leguminous plants and barn manures.

Fertility may frequently be promoted by light applications (20 to 30 bushels per acre) of quick lime. Lime may serve to make plant-food more available, improve soil texture and correct acidity. Its use is especially recommended on clay and moist lands and in orchards where the ground is much shaded. Applications of gypsum and salt are sometimes beneficial in maintaining fertility, but they, as well as lime, usually act indirectly, as the soil is seldom deficient in these constituents so far as they are required as plant-food. On high-priced lands, especially those devoted to horticulture, the soil should be made and kept fertile—well up to its highest productive power.

Sometimes soils are rendered unfruitful by the presence of deleterious substances, as organic acids or alkaline salts, or a superabundance of some one or more of its usually useful ingredients, as water or nitrogenous matter. An excess of nitrogen stimulates the growth of stalk and straw at the expense of grain, or in the orchard it tends to the formation of wood rather than to fruitfulness. The acidity should be corrected by lime, as noted above, the surplus water removed by drainage, the nitrogenous matter reduced by the production of such crops as are not harmfully affected by its superabundance, such as forage crops which are prized for their foliage rather than for their seeds, while the alkalinity may sometimes be overcome by deep tillage or irrigation.

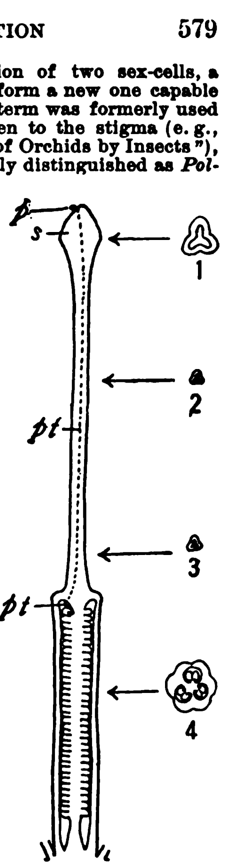
I. P. ROBERTS.



814. A pollen grain of Lilium Philadelphicum.

Before leaving anther, seen in section; *t*, the tube cell; *g*, the generative cell. The large spherical body in each cell is the nucleus. Magnified 500 diameters.

FERTILIZATION. The union of two sex-cells, a male cell and a female cell, to form a new one capable of growing into a plant. The term was formerly used to include the transfer of pollen to the stigma (e. g., Darwin's "On the Fertilization of Orchids by Insects"), but this process is now generally distinguished as *Pollination*, which see. In the lower plants, fertilization can be much more readily observed than in the seed plants, because in the latter it takes place inside of opaque parts, and therefore can be studied only by the most careful microscopical methods. The process of fertilization is here described as it occurs in lilies. In other seed plants it differs in details.



815. Outline of a pistil of Lilium Philadelphicum.

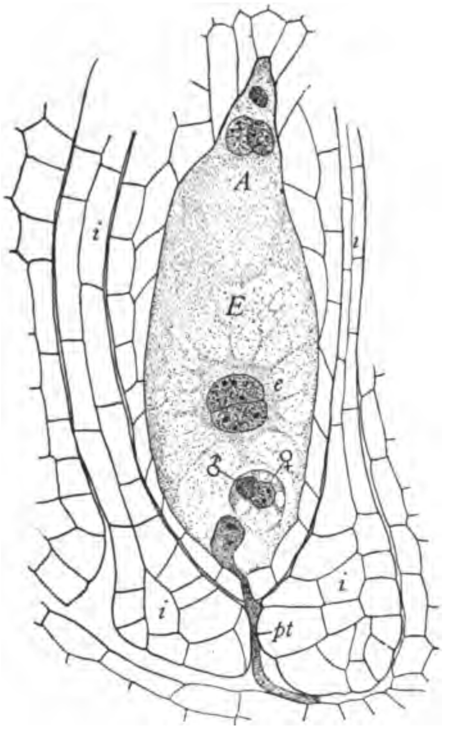
Cut lengthwise almost through the center; *s*, stigma on which pollen grain, *p*, has been lodged. The course of the pollen tube, *pt*, is indicated by broken line. At the right, 1, 2, 3, 4, are cross sections of the pistil at the levels indicated by the arrows: 1, the stigma; 2, 3, the style, show the triangular canal which leads into the three chambers of 4, the ovary, in each chamber of which are two rows of ovules. Natural size.

The generative cell (*g*, Fig. 814) is produced by the pollen grain before it leaves the anther. It is usually lenticular, and placed at one end of the grain. Its most important part is the spherical nucleus, which occupies the center. When the pollen grain is conveyed to the stigma (*s*, Fig. 815), the larger cell (*t*, Fig. 814), nourished by food it absorbs from the stigma, grows, forming a long tube (*pt*, Fig. 815), which traverses the narrow triangular canal (1, 2, 3, Fig. 815) that leads down the long style to the ovary. In many plants the style is not hollow. In this case, and often when it has a canal, the pollen tube pushes its way between the cells of the style, living on the food it absorbs. About the time the tube begins to grow (or later) the generative cell divides into two. These male cells, or sperms, migrate down the tube (*pt*, Fig. 815), which makes its way into the opening between the inner integument (*i*, Fig. 816) of the ovule, penetrates the body of the ovule and enters the embryo-sac (*E*, Fig. 816). Its direction of growth is determined by substances, probably chiefly the sugars, contained in the parts which it traverses.

While the pollen tube has been growing, the female cell has been forming in the embryo-sac (*E*, Fig. 816). The nucleus of this huge cell, originally single, has divided into two, these into four, and these into eight nuclei, four migrating to each end. Then one from each group advances toward the middle of the sac and the two fuse into one (*e*, Fig. 816). One group of three (sometimes after dividing again and again, sometimes only the original three) may organize cells at the antipodal end of the embryo sac (*A*, Fig. 816). In the lilies, however, this does not go far, and two of the three antipodal nuclei are seen to be already reduced in size and partially disorganized. They have no further history. The group of three nearest the point of entrance of pollen tube accumulate the living protoplasm about them and thus organize three naked cells. Two of these (called synergidæ) usually begin to disorganize before the pollen tube reaches them, but may persist until then or even later. In the lilies they usually disappear early. The third is the *egg*, or oösphere. When the pollen tube enters the embryo-sac, its end becomes softened and bursts, permitting one or both of the male cells to migrate from it. One male nucleus

(♂, Fig. 816) fuses with the nucleus of the egg (♀, Fig. 816), and fertilization is complete. The other, heretofore supposed to be disorganized, is now said to fuse with the endosperm nucleus (*e*, Fig. 816). The fertilized egg begins at once to grow and forms the embryo, while the endosperm nucleus divides and forms cells in which food may be stored for the embryo when it resumes growth at the time of germination.

Charles Reid Barnes.



816. Part of an ovule of Lilium Philadelphicum.

Cut lengthwise; *i, i*, inner integument, enclosing, except at a narrow orifice where the pollen tube, *pt*, enters, the body of the ovule, which is chiefly occupied by the large embryo sac *E*. *A*, antipodal end of embryo sac with three nuclei, one much disorganized. *e*, the endosperm nucleus, just being formed by fusion of two nuclei from the respective ends of the embryo sac. ♂, male nucleus, which has just migrated from pollen tube and is about to fuse with ♀, the egg nucleus. The synergidæ have disappeared. Magnified 670 diameters.

FERTILIZERS. There is one fact that has been fairly well established by experiment and inquiry, namely, that fruits, flowers and vegetables are benefited by the intelligent application of manures and fertilizers, and that, in the majority of cases, such application is followed by profit. In the first place, these crops should be classified for purposes of fertilization according to their period of growth, the first class including the perennial fruits and flowers, and the second, the annual flowers and vegetables. Those of the first class differ from ordinary crops in that a longer season of preparation is required, during which time the growth is vegetative rather than productive, though upon this vegetative growth depends the quality and value of the fruit or flower obtained. The growth of both tree and fruit is dependent, too, not only upon the food acquired during its year of growth, but also upon that previously acquired, and which has been stored up in bud and branches.

The tree fruits include apples, pears, peaches, plums, cherries, apricots, etc. It may be regarded as a safe assumption that the fertility elements, phosphoric acid, potash and lime, contribute materially to the proper growth and hardening of the wood, as well as the maturation of the fruit. The necessity for added nitrogen is, on the whole, much less; it should be applied as the need for it appears in the lack of vigor of the tree.

In the next place, it is safe to assume that the materials which furnish these elements or constituents in slowly available forms are liable to be quite as useful, except under special conditions, as those which are quickly available, because the tree growing continuously, though slowly, is able to obtain from the gradually dissolving substances a sufficient amount for its daily needs. Hence, as a rule, fertilizers for fruit trees may include the less available and cheaper forms of constituents.

Apples and Pears.—On soils of good natural character, the fertilization of apples and pears need not begin until the trees reach the bearing period, when an annual dressing of 400 pounds per acre of either of the following mixtures should be applied in early spring, and plowed in:

No. 1.—One part, or 100 pounds each, of ground bone, acid phosphate and muriate of potash.

No. 2.—One and one-half parts, or 150 pounds, of ground bone, and one part, or 100 pounds, of muriate of potash.

As the trees grow older, these dressings should be increased. While no definite rules can be laid down as to the most profitable amounts to apply, the best growers find that for mature trees it pays to use from 1,000 to 1,500 pounds annually. In many cases nitrogen, in addition to that contained in the mixture, should be used, the kind and form depending, perhaps, upon the relative cost more than upon any other one thing, the minimum amount to be 20 pounds per acre, or an equivalent of 125 pounds of nitrate of soda. In many cases it is possible to obtain the necessary nitrogen from the growing of leguminous crops, as crimson clover and red clover, though when these are used they should be plowed down early in the spring, in order that their growth may not interfere with the growth of the tree. If they are allowed to remain until mature, they absorb not only the food that may be necessary for the growth of tree and fruit, but the moisture also, and thus they frequently injure rather than improve the crop prospects. On poor soils, the necessity for fertilization is naturally greater. In fact, on these liberal fertilization —500 pounds per acre—should precede the setting of the trees, and be continued annually. On these soils, too, green manuring, as a source of nitrogen, can be practiced with safety for a longer period than in the preceding case.

Peaches.—Peaches differ from apples and pears in respect to fertilizing. The demands for added plant-food are proportionately greater in the early life of the tree, and are different because of their more rapid growth, their early bearing, and the exhaustive character of the crops. On soils of good natural character, however, the necessity for fertilizing is seldom apparent until after the first or second year of growth. That is, good soils will provide sufficient food for a normal development of leaf and wood, and any additional fertilization would have the tendency to unduly increase the tree growth. On medium and poor soils, the setting of the trees should be preceded by a fertilization, preferably broadcast in spring, and plowed in, with one or the other of the mixtures recommended for apples and pears, as follows:

No. 1.—One part, or 100 pounds each, of ground bone, acid phosphate and muriate of potash.

No. 2.—One and one-half parts, or 150 pounds, of ground bone and one part, or 100 pounds, of muriate of potash.

On the better soils, No. 2, and on the poorer, No. 1, at the rate of 400 to 600 pounds per acre, which should be followed by the application of the more soluble fertilizers, immediately the trees begin to bear. The need of nitrogen is often very marked, and is shown by a lack of vigor of the tree. Nitrate of soda applied broadcast in early spring has proved a very valuable form of nitrogen, since it is appropriated by the roots during the early season, and if a sufficient abundance of the minerals is present, it enables a normal development of leaf and branch. If the quick-acting nitrogenous fertilizers are applied late, or if too large applications of the slower-acting nitrogenous materials are applied early, the tendency is to provide for a continuous feeding on nitrogen, and thus encourage an undue development of leaf and branch, which does not permit the ripening of the wood before the beginning of winter. Thus, on these soils, in addition to an annual application of the basic formula, from 100 to 150 pounds of nitrate of soda, 200 pounds of acid phosphate and 100 pounds of muriate of potash should be applied early in the season and carefully worked into the soil.

Plums, Cherries and Apricots.—The fertilizing of these fruits, when grown on the different classes of soils, need not differ materially from that recommended for peaches under the same conditions, though cherries, particularly, require, in addition, a relatively greater supply of lime, which should be applied at the rate of 30 bushels per acre once in about five years, and thoroughly incorporated with the soil.

Small Fruits and Berries.—These, in respect to their general character, correspond more nearly with the vegetable crops than with the cereal grains or fruits, hence, in most cases, natural sources of plant-food are ignored, and the more quickly available materials, particularly nitrogenous and phosphatic, applied.

In the case of strawberries, it is desirable that the soil in which the plants are set should be supplied with soluble and available phosphoric acid; hence an application, broadcast previous to setting, of from 500 to 800 pounds per acre of the mixture No. 1, is recommended. The nitrogen should also be in quickly available forms, and should be supplied in sufficient quantities at time of setting the plant to enable it to mature, and thus to better withstand the rigors of winter. Hence, an additional application of 100 pounds of dried blood, or its equivalent in nitrate of soda or ammonia, is advisable, particularly on soils not previously well enriched with organic nitrogenous matter. In the spring of the season during which the first crop is harvested, dressing with a quick-acting fertilizer, rich in nitrogen, is desirable, carefully applied between the rows, and preferably worked into the soil.

Raspberries and blackberries also require a soil well enriched with the mineral elements, to insure an abundant and strong growth of canes. The need for nitrogen, while apparent, is less marked than in the case of the strawberries, and the slower-acting forms serve a good purpose, provided they are not applied in too great quantities, so as to encourage a large growth of plant, which does not fully mature. An annual application of mixture No. 2 is recommended at the rate of 400 to 600 pounds per acre.

Currants and gooseberries are less likely to need nitrogen than the other berry crops, because of the tendency to the development of mildew. In common with the other crops mentioned, they should be abundantly supplied with the minerals (phosphoric acid and potash), and mixture No. 1 may be used at the rate of 500 to 1,000 pounds per acre.

Grapes.—Grapes are more exhaustive than most of the fruit crops, largely because of the larger total crop harvested, and the special need is for phosphoric acid and potash. These elements may be supplied by mixtures No. 1 or No. 2, and very liberal dressings are recommended—from 800 to 1,500 pounds per acre annually—after the bearing period begins.

Roses and other Flowering Plants.—In the growing of flowers and herbaceous plants, phosphoric acid is particularly needed, and it has been demonstrated that ground bone is one of the most useful forms from which to obtain it, since it furnishes both nitrogen and phosphoric acid in slowly available forms. A good mixture for both the field and prepared soils may consist of four parts of ground bone and one of muriate of potash, applied at the rate of four pounds per square rod, and preferably worked into the soil previous to setting the plants; the after application may be made in the fall at the same rate.

Vegetable Crops.—Vegetables constitute a group of plants distinguished from all others, both because of their peculiar habits and of their purposes of growth. Both having an important bearing upon fertilization, they should all be supplied with an abundance of available food. Since nitrogen is the one element that more than any other stimulates leaf and stem growth, its use is extremely beneficial for all of these crops, and because of their relatively high commercial value the quantity of fertilizer may be greatly in excess of that for the other groups. While a classification of these crops is possible, a fertilizer of the following composition may be regarded as a basic mixture for the entire group:

Nitrogen	4%
Phosphoric acid	8%
Potash	10%

The nitrogen should be derived in part from quickly available sources, and the phosphoric acid should be all soluble or available, and the potash from muriate. This should be applied in part broadcast, and in part in the row at time of planting, at the rate of 1,000 to 1,500 pounds per acre, and upon soils naturally poor, two or three additional annual top-dressings with nitrate of soda, at the rate of from 50 to 100 pounds per acre, will prove very serviceable.

Edward B. Voorhees.

FÉRULA (possibly the stems were anciently used as ferules). *Umbelliferæ.* Giant Fennel. This large genus includes 2 hardy herbs, which are, perhaps, the tallest plants cult. for ornament in this large (but from the garden standpoint unimportant) order. They are valued for the excessive fineness with which their foliage is cut, and their clusters of perhaps 40–50 umbels of minute yellow fls. borne on stout stems, which rise far above the foliage. **F. Tingitàna**, Linn., from N. Africa, has lvs. 4 times ternately pinnatisect, somewhat glaucous. B.M. 7267. The common error that it comes from Spain goes back to Morison, 1680. Lindley originated the false notion that this plant is the source of gum ammoniac. **F. commùnis**, Linn., from S. Eu., has deep green lvs., with more linear segments and more compact habit.

W. M.

FESSENDEN, THOMAS GREEN, editor and author, 1771–1837, founded "The New England Farmer" at Boston in 1822, and edited it until his death. The present "New England Farmer" is not the lineal successor of Fessenden's paper. Fessenden is chiefly noted as a satirical poet, and he was more of a literary man than a gardener. He was born at Walpole, N. H., was graduated at Dartmouth College in 1796, and studied law. He went to England in 1803, and there published his humorous poem, the "Terrible Tractoration." He settled in Boston about 1804. In addition to "The New England Farmer," he edited the short-lived "Horticultural Register," and "The Silk Manual." He wrote "The Complete Farmer and Rural Economist," "The New American Gardener," and "The American Kitchen Gardener," three books of a cyclopedic nature designed to cover the fields of agriculture, horticulture and vegetable gardening respectively. They adhered very closely to the contemporaneous English type of horticultural writing. These books profess to have passed through many editions, but they were little altered from issue to issue. They often seem to lack the enthusiasm of direct contact with growing plants. Fessenden's time was one of general farming, and the view-point of gardening was mostly that of the home or amateur. He lived before the days of specialized farming on a large scale, and of commercial horticulture and floriculture. During the greater part of his editorship of "The New England Farmer" there was but one other important American agricultural paper, "The American Farmer," which was published at Baltimore, beginning 1819. The most important contemporaneous American writings on horticulture of a cyclopedic nature were "The American Gardener's Calendar," by Bernard M'Mahon, Philadelphia, 1806, and "The American Gardener" of John Gardiner and David Hepburn, Georgetown, D. C., 1804. For a copy of "The Country Lovers," Fessenden's once famous song to the tune of Yankee Doodle, together with Hawthorne's pen-picture of the man, and an account of his interesting life, see Duyckinck, Cyc. Am. Lit. 1:595–599.

W. M.

FESTŪCA (an ancient name of uncertain meaning). *Gramineæ.* Fescue Grass. Usually cespitose, perennial grasses of varying habit. Lvs. rather dry, harsh, and usually narrow. Spikelets several, in dense or loose and spreading panicles; empty glumes unequal, mostly keeled; flowering-glumes not keeled, pointed. Species about 80, in all parts of the world. They are essentially permanent pasture grasses, but some are useful for lawns and ornamental purposes.

glaùca, Lam. (*Festùca ovina*, var. *glaùca*, Hack.). Blue Fescue Grass. A handsome, tufted, hardy perennial grass, with deep, silvery blue leaves resembling the common Sheep's Fescue (*Festuca ovina*), and by most authors regarded as a variety of it. Lvs. very narrow, conduplicate: panicle somewhat one-sided and short: spikelets 3–8-fld., with a short awn.—An attractive plant for edgings or for contrast of foliage with deeper colored plants. Often used also in hanging-baskets, window-boxes and the rockery. It will grow almost anywhere if not too densely shaded. Propagated by division of the tufts.

amethýstina, Host. (*F. ovina*, var. *psammóphila*, Hack.). A very pretty grass with violet-colored culm and sheaths: lvs. somewhat thin and long, blue-green: panicles slightly branched, small, often violet-colored: spikelets short-awned, seldom awnless. Europe.—Useful as an ornamental grass in the garden for dry, sunny places. Propagated by division.

Various Fescues are used in pastures and in lawn grass mixtures. *F. duriúscula*, Linn. (Festuca ovina, var. duriuscula, Hack.). A slender, densely tufted perennial grass, 1–2 ft. high: lvs. very fine, radical, closely resembling Sheep's Fescue. Panicle open. Eu. Thrives on dry, sandy soils unfit for the growth of better grasses. It possesses some value as a lawn grass, but if used for this purpose should be sown thickly and unmixed with other grasses.—*F. heterophýlla*, Lam. A rather slender perennial European grass, 2–4 ft. high: lvs. of two distinct forms, the radical ones 3-nerved, narrow, hairy and folded together; those on the culms much broader, flat, and 5–7-ribbed: panicle large, open and nodding at the apex. Eu. It is an excellent grass for woodland parks, where it is too shady for the successful growth of other lawn grasses.

P. B. Kennedy.

FETTICUS. Another name for *Corn Salad.*

FEVERBUSH. See *Benzoin.*

FEVERFEW. *Chrysanthemum Parthenium.*

FEVER TREE is *Pinckneya pubens.*

FEVERWORT. *Triosteum.*

FIBER PLANTS are treated only incidentally in this work. Division of Publications, U. S. Department of Agriculture, Washington, D. C., issues free publications of the Office of Fiber Investigations.

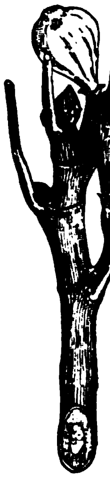
FÌCUS (ancient Latin name). *Urticàceæ.* The Fig, the India Rubber Plant, the Banyan Tree and the Creeping Fig of conservatory walls belong to this vast and natural genus, which has over 600 species scattered through the warmer regions of the world. Ficus has no near ally of garden value. It is a genus of trees or shrubs and climbers, with milky juice. In the common Fig the lvs. are deeply lobed, but in most of the other species they are entire or else the margin is wavy or has a few teeth or an occasional small lobe. The lvs. are nearly always alternate, *F. hispida* being the only species of those described below which has opposite lvs. The foliage in Ficus varies all the way from leathery to membranous, and is astonishingly variable in venation, so that the veins are very helpful in telling the species apart. What the horticulturist calls the Fig, or fruit, is the fleshy receptacle, while the fruit of the botanist is the seed inside (Fig. 817). In the following account fruit is used instead of receptacle.

The fertilization or caprification of the Fig is one of the most surprising, interesting and complicated chapters in natural history, and is of great practical importance. See *Fig*, where the culture of *F. Carica* is discussed.

The most important ornamental plant in the genus is the India Rubber Plant (*F. elastica*), which probably ranks amongst the 25 most popular foliage plants for home use indoors. Its culture is given below at length. This is one of the most important rubber-producing plants. See *Rubber Plants.*

The Creeping Fig (*F. pumila*, better known as *repens* or *stipulata*), is one of the commonest and best climbers for covering conservatory walls. It clings close and makes a dense mat of foliage, which is about as dark in color as the English ivy. The plant has been cult. since 1771, but within the last quarter century has come to be recognized as the best plant there is for its special purpose. Once in a long while it fruits in conservatories, and the fruiting branches are very unlike the barren ones. They stand out from the conservatory wall instead of lying flat and close. The lvs. of the barren branches are less than an inch long and heart-shaped, with one side longer than the other at the base and a very short petiole; the lvs. of fruiting branches are 2–3 inches long, elliptic-oblong, narrowed at the base, and with a petiole sometimes half an inch long.

Among the many wonders of the genus Ficus are the epiphytal habit of some, the huge spread of the Banyan Tree (*F. Benghalensis*), and the fact that some species ripen their fruits under ground. Some of the tallest tropical trees are members of this genus, and often they begin life by climbing upon other trees. The Ficus often overtops and outlives the other tree, which may be seen in every stage of decay, or may have entirely disappeared, leaving the giant climber twined spirally around a great hollow cylinder. The Banyan Tree sends down some of its branches (or aërial roots) into the soil, these take root, make new trunks, and eventually produce a great forest, in which it is impossible to tell the original trunk. The Banyan in the botanic gardens at Calcutta sprung from a seed probably dropped by a passing bird into the crown of a date palm a little more than a century ago. The main trunk is now 42 ft. in circumference; there are 232 additional trunks, many of them 8–10 ft. in circumference, and the branches extend over an area 850 ft. in circumference, forming a dense evergreen canopy through which sunlight never penetrates. The Banyan under which Alexander camped, and which is said to have sheltered 7,000 men, now measures 2,000 ft. in circumference and has 3,000 trunks. Other species have the same method of propagation, but *F. Benghalensis* is the most famous.



817. Young Figs. Showing how they arise from the axils of the leaves.

The various species of Ficus are cultivated for fruit, for ornament in greenhouses, and for shade outdoors in the extreme South, as indicated in the key by A, AA, and AAA. The shade trees are procurable from southern Florida and southern California.

Index of names (synonyms in italic):

aurea, 18.
australis, 7.
Benghalensis, 20.
Carica, 1.
elastica, 2 and 14.
erecta, 3.
glomerata, 11.
hispida, 10.
Indica, 19.
infectoria, 12.
macrocarpa, 4.
macrophylla, 15.
minima, 8.
nitida, 17.
oppositifolia, 10.
Palmeri, 16.
Parcelli, 6.
pumila, 8.
quercifolia, 5.
radicans, 9.
religiosa, 21.
repens, 8.
retusa, 17.
rubiginosa, 7 and 13.
stipulata, 8.

A. *Cult. for fruit.*

1. **Càrica**, Linn. Figs. 817, 821, 822. Height 15–30 ft.: lvs. 3–5-lobed, the lobes more or less wavy-margined or lobed, and with palmate veins, whereas nearly all species mentioned below are pinnately veined: fr. single, axillary, pear-shaped. Supposed to be a native of Caria, in Asia Minor. Makes a fine pot-plant, and fruits freely in northern conservatories. For culture, see *Fig.*

AA. *Cult. indoors for ornament, hence not tall trees under these conditions.*

B. *Habit erect, not climbing.*

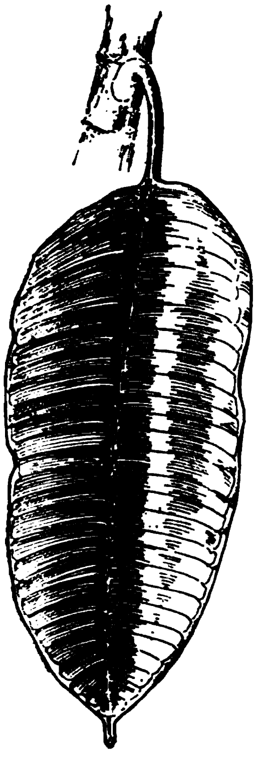
C. *Under surface of lvs. not rusty.*

D. *Foliage not variegated (except in a variety of No. 2).*

E. *Lvs. entire or with margins wavy, not lobed.*

F. *Nerves numerous, 50 pairs or so.*

2. **elástica**, Roxb. INDIA RUBBER PLANT. Figs. 818, 820. Lvs. 3–12 in. long, shining, leathery, oblong to elliptic, with an abrupt, dull point; nerves parallel, running at nearly right angles from midrib to margin: fr. in pairs, sessile, in axils of fallen lvs., covered at first by a hooded involucre, when ripe greenish yellow, ½ in. long. Damp forests of trop. Asia. G.F. 2:547.—Becomes 100 ft. high in tropics, but becomes unsightly under glass at 8 or 10 ft. Cult. plants mostly have a single stem, but there is a growing demand for compact and branching plants. Var. **variegàta** (var. *aurea*, Hort.) is much less popular. Lvs. creamy white or yellow near the edges. J. D. Eisele says it is liable to fungous diseases. This species is also grown South as a shade tree. The nervation is very characteristic. So, also, is the handsome rosy sheath which incloses the young lvs., and which soon drops off. This is regarded as a stipule of exceptionally great size.



818. Leaf of Rubber Plant, showing venation. F. elastica (X¼).

FF. *Nerves about 8 pairs.*

3. **erécta**, Thunb. Extraordinarily variable: shrub to small tree, glabrous, pubescent, or almost strigose: lvs. broadly ovate, obovate or elliptic (lanceolate in var. Sieboldii), entire or with here and there a lobe, or rather coarsely dentate above the middle: fr. single or in pairs, peduncled or subsessile, and either globose and not stalked or pear-shaped and long-stalked. Himalayas. China, Japan. B.M. 7550 (where the lvs. look rather leathery). Procurable through dealers in Japanese plants.

FFF. *Nerves about 3 pairs.*

4. **macrocárpa**, Wight. Becomes a large, climbing tree: lvs. 5 in. long, membranous, broadly ovate; petiole 2–2½ in. long: fr. 1–2½ in. thick, spotted, globose, in cauline clusters. India.—This name was once adv. by John Saul, who spoke of the plant as a shrub with leathery lvs.

EE. *Lvs. deeply lobed, not merely wavy.*

5. **quercifòlia**, Roxb. The oak-leaved form is the typical one, but King includes *F. humilis*, Roxb., in which the lvs. are serrate or nearly entire and not lobed. Lvs. 2–5 in. long, "thickly membranous;" nerves 5–7-pairs; petiole ½–1 in. long: fr. in axillary pairs, egg- or pea-shaped. Burma, Malaya, where it is a shrub, often creeping or decumbent. L.B.C. 16:1540 (fruiting soon after importation, when 2 ft. high). Adv. 1895 by Pitcher and Manda. Voss refers this, with many other synonyms, to *F. heterophylla*.

DD. *Foliage variegated.*

6. **Parcélli**, Veitch. Lvs. thin, membranous, light green, mottled with cream-white, more or less in the manner of mosaic, oblong-oval, acuminate, dentate. Islands of Pacific. F.S. 22:2273. F.M. 1874:124.—Int. by Veitch about 1874. A warmhouse shrubby plant; probably the most popular of the variegated forms of Ficus. J. D. Eisele says it is readily prop. by cuttings of half-ripened wood placed in sand in brisk bottom heat Also cult. in S. Calif., where it bears tricolored fr.

CC. *Under surface of young lvs. rusty.*

7. **rubiginòsa**, Desf. (*F. austràlis*, Willd.). Lvs. leathery, rounded or cordate at base, notched at tip: fr. mostly in pairs, globular, 5–6 lines thick, usually warty. Australia, where it throws out aërial roots like the Banyan Tree. B.M. 2939.—The rusty color is a beautiful feature. Voss considers this a form of *F. elastica*.

BB. *Habit climbing or trailing.*

C. *Form of lvs. ovate, obtuse, unequally heart-shaped at base.*

8. **pùmila**, Linn. (*F. stipulàta*, Thunb. *F. rèpens*, Hort., not Rottl.). CREEPING FIG. Fig. 819. Prostrate or climbing shrub, clinging close to conservatory walls and then flattened. Lvs. more or less 2-ranked, on very short petioles, ovate, obtuse, entire or slightly wavy, rounded or cordate at the base, often unequally; veins prominent below. Japan, China, Australia. B.M. 6657. R.H. 1891:448. G.C. II. 14:560, 561, 717. Var. **minima** (*F. minima*, Hort.) has smaller lvs. The species is sometimes used for hanging baskets.

CC. *Form of lvs. oblong-acuminate, slightly notched at base.*

9. **radicans**, Desf. Garden plant, with green, oblong-acuminate lvs. and trailing habit. Imperfectly known. Habitat unknown. Var. **variegàta**, Hort. W. Bull., has lvs. irregularly marked with creamy white, the variegation beginning at the margin. G.C. III. 22:185. A.G. 19:527. Int. 1897.

AAA. *Cult. outdoors in southern Fla. and Calif. for shade, etc., hence often tall trees.*

B. *Arrangement of lvs. usually opposite.*

10. **hispida**, Linn. f. (*F. oppositifòlia*, Willd.). Shrub or small tree: lvs. entire or toothed: fr. clustered on old wood or leafy branches, hispid, yellowish. Asia, Trop. Australia.

BB. *Arrangement of lvs. alternate.*

C. *Texture of lvs. membranous, not leathery.*

D. *Lvs. tapering to a point; base entire, obtuse.*

11. **glomeràta**, Roxb. CLUSTER FIG. Lvs. 4–7 in. long; nerves 4–6 pairs: fr. clustered on leafless, scaly branches, pear- or top-shaped, 1¼ in. thick, reddish. India, Burma.—"A quick-growing, evergreen shade tree."—*Reasoner*. "A dense shade tree: lvs. have a peculiar metallic luster: small fruits, much relished by cattle and children."—*Franceschi*.

DD. *Lvs. with an abrupt, short, acuminate apex; base notched.*

12. **infectòria**, Roxb. Lvs. 3½–5 in. long; nerves 5–7 pairs: fr. in axillary pairs, sessile, globose, ¼ in. thick, whitish, flushed and dotted. Trop. Asia, Malaya.—Grows 60 ft. high, and is one of the best shade trees.

CC. *Texture of lvs. leathery, not membranous.*

D. *Under surface of lvs. rusty.*

13. **rubiginòsa**, Desf. Described at No. 7.

DD. *Under surface of lvs. not rusty.*

E. *Stipules very large, rosy, inclosing the young lvs. when young and falling off afterwards.*

14. **elastica**, Roxb. Described at No. 2.

15. **macrophýlla**, Desf. MORETON BAY FIG. Lvs. 6–10 in. long, 3–4 in. wide: stipules 2–4 in. long: fr. nearly globular, 9–12 lines thick, axillary, in 3's or 4's, on short, thick peduncles. Austral.—Much planted in southern and middle California, where, however, it does not perfect seed. F. von Mueller says it is perhaps the grandest of Australian avenue trees.

EE. *Stipules not exceptionally large and not rosy or deciduous.*

F. *Young lvs. densely covered with wool beneath.*

16. **Pálmeri**, Watson. Tree, 8–12 ft. high, branching near the ground : lvs. 3 in. long, 2–2½ in. wide ; petiole 1 in. long : fr. in pairs, axillary, globose, ½ in. thick. Discovered on San Pedro Martin Island, northwestern Mexico, 1887.—Perhaps the best adapted to severely hot and dry places. Franceschi says it attains 30 ft.

FF. *Young lvs. not woolly.*

G. *Base of lvs. narrowed.*

H. *Stipules glabrous.*

17. **retùsa**, Linn. (*F. nítida*, Thunb., and Hort., not Blume). Lvs. 2–4 in. long; nerves 5 or 6 pairs; petiole 3-6 lines long: fr. sessile, in pairs, axillary, 4 lines thick, yellow or reddish. Trop. Asia, Malaya.—A large evergreen tree with a few aërial roots.

18. **aùrea**, Nutt. Branches pale, smooth, furrowed : lvs. 3–4 in. long, smooth, oblong, entire, narrowed but obtuse at each end, stout-petioled : fr. orange-yellow, globose, 4 lines thick. S. Fla.—Reasoner says it is a handsome decorative plant for the florist, and that it grows 60 ft. high. Chapman describes it as a small tree; he says nothing about stipules. Tender in Santa Barbara.

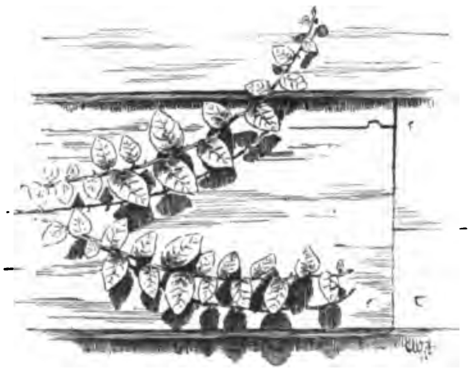
HH. *Stipules not glabrous.*

19. **Índica**, Linn. Not the Banyan Tree. Glabrous throughout, except stipules : lvs. 4–7 in. long ; nerves about 4–6 pairs, not very prominent ; petiole 4–12 lines long ; stipules 6–9 lines long : fr. in crowded pairs, sessile, globose, smooth, yellowish red, 4 lines thick. Trop. Asia, Malaya.—This species is greatly confused in botanical literature with *F. Benghalensis*, but *F. Indica* does not take root from its branches, as does the Banyan Tree. In recent writings *F. Indica* is often given as a synonym of *F. Benghalensis*, but the distinctions here given are those made by King, in Flora British India 5: 499 (1890). Tree grows 50 ft. high.

GG. *Base of lvs. rounded.*

H. *Nerves about 5 pairs : lvs. 4–8 in. long.*

20. **Benghalénsis**, Linn. BANYAN TREE. Also written *Bengalensis*. Young parts softly pubescent : nerves prominent; petiole 6–18 lines long; stipules 9–12 lines long : fr. in pairs, sessile, globose, puberulous, red, about the size of a small cherry. Trop. Africa, India.—A tree, 70–100 ft. high, rooting from the branches, thus forming accessory trunks and extending the growth of the tree indefinitely. For an explanation of the confusion between Benghalensis and Indica, see Hooker's Flora Brit. India 5:499, 500.



819. The Creeping Fig on a conservatory wall.
Ficus pumila, better known as *F. repens* or *F. stipulata*.

HH. *Nerves about 8 pairs : lvs. 4½–7 × 3–4½ in. long.*

21. **religiòsa**, Linn. PEEPUL TREE of the Hindoos. Petiole 3–4 in. long ; stipules minute : fr. in axillary pairs, sessile, dark purple, ½ in. thick. India. Gn. 1, p. 435.—Grows 100 ft. high, and the lvs., suspended on their long, flexible petioles, rustle in the slightest breeze.

F. Afzélii, G. Don, is a plant from S. Afr., never described by Don. The plant in the trade is said to be F. eriobotroides. Once advertised for indoor ornament by Pitcher & Manda.—*F. carnòsa*, Hort. Advertised 1895 by Pitcher & Manda for indoors.—*F. Chauvièrii*, Hort. In Europe this is said to be second only to F. elastica. Franceschi says it has broader and more oval lvs., and comes from New Caledonia, where it attains 60 ft. J. D. Eisele says that it has oval lvs. with creamy white veins, is strong-growing, and should be valuable for subtropical gardening.—*F. Coòperi*, Hort., is cult. indoors from trop. Amer. Advertised 1895 by Pitcher & Manda.—*F. Cùnninghami* is a new species of great size, producing aërial roots ; introduced by California Experiment Station, and recommended by Reasoner Bros. for house culture in the South. Presumably from Austral.—*F. eriobotroides*, Kunth & Bouché. Habitat unknown. See F. Afzelii.—*F. falcàta*, Miq., is cult. but not advertised. A creeper with lvs. often of 2 forms, leathery, tesselately dotted and colored beneath. It is a form of F. punctata, with lvs. oblong or subrhomboid, obtuse, not tapering below. India. Before No. 8 in the key.—*F. lùcida*, Dryand. From India, but not described in Flora of British India. Advertised 1893 by John Saul for indoors.—*F. princeps*, Kunth & Bouché. Braz. Cult. by Franceschi, who says it grows 60 ft. high and has magnificent foliage, which is bronze and copper-colored when young.—*F. pyrifòlia* may be F. Benjamina, erecta, Fontanesii or rubra. The name is advertised by Yokohama Nursery Co., who also advertise F. erecta.

W. M.

FICUS ELASTICA, or the Rubber Plant as it is known all over this country, is perhaps the most popular and satisfactory house plant that has ever been cultivated. It is a plant for the million. Some florists have several houses especially devoted to the propagation and cultivation of this tough and thrifty plant. There are also thousands upon thousands of young plants or rooted cuttings from thumb-pots imported into this country, especially from Belgium and Holland, for marketing every spring. It is estimated that from 75,000 to 80,000 Rubber Plants were sold in America during the last year. There are several varieties of the Rubber Plant, but the true *Ficus elastica* is the best, both for growing and for selling. It can be easily told from the smaller-leaved variety, which is smaller and lighter colored in all its parts, the stem being smoother, and the sheath that covers the young leaves lacking the brown tint, which often runs into a bright and beautiful Indian red.

The method of propagating now popular in America employs old, bushy stock-plants, either in pots or tubs, or planted out into a bed where the night temperature can be kept from 60° to 75° F. As soon as the young shoots are 5–6 in. long they are operated upon. An incision is made at the place where it is intended to root the young plant, cutting upward on a slant midway between two eyes, making the cut anywhere from 1–2 in. long, according to the thickness and length of the young shoot or branch. A small wedge, as a piece of match, is then inserted to keep the cut open. A large handful of clean, damp, well prepared moss is then placed around the branch to cover the cut and is tied moderately firm with twine or raffia. Some use a small piece of charcoal for a wedge in the cut; others coat the two cuts with a mixture of charcoal dust and lime. The latter practice, in the opinion of the writer, is beneficial in that it expedites the callusing of the cuts and the rooting of the young plant after being cut and mossed. The moss should be kept constantly moist, and the higher the temperature, within reasonable limits, the quicker the rooting process goes on. The roots of the young plant usually appear on the outside of the oval-shaped bunch of moss. A complete cut can then be made below the moss and the young plant potted. The smaller the pot at first the better. The leaves of the young plants should be tied up in order that they may not be injured by coming in contact with one another or by lying flat on the pots. The young plants now require a gentle bottom heat and frequent syringing,—a dozen times on clear days. As soon as the young plants are taken from the stock-plant, a little wax should be put on the end of the cut to prevent the milky sap from escaping. The best time of the year to propagate and root Ficus is from the first of January to May. The European growers never start much before the Christmas holidays; and from then until spring they make all their cuttings.

The older method of propagating Rubber Plants is still the favorite one abroad; it employs single-eye cuttings. Sometimes, if the branches are very thick, only one-half the stem is taken with the eye and a single leaf, the leaf being curled up and tied with raffia, and the small piece with the eye set into the propagating bed. This is a bed of sharp sand, or sometimes of sand and chopped sphagnum moss or fine cocoa-fiber. Frequently the single-eye cuttings are put at once into the smallest sized thumb-pot, with a mixture of very finely ground potsherd and charcoal filling about one-half the pot, and either soil or sand for the balance. A small stick is used to hold the leaf upright. These pots are plunged into the propagating benches in either sand, moss or fiber, and a steady bottom heat of from 75° to 80° is applied and kept up until the plants are rooted. As a rule, such beds are inclosed in a glasshouse, in order to keep about them close, warm and moist atmosphere. Only ventilation enough to permit the moisture caused by the evaporation to escape is allowed on these beds. In this country, propagation by the first described method can be continued nearly all the year round. From experience of both methods, the writer can say that the top-cutting and mossing process is better by far, especially where plenty of stock plants can be maintained.

820. Ficus elastica, the Rubber Plant of florists.

After being shifted from the smaller sized pots into 3- or 4-in. pots, the young plants will stand a great deal of liquid manure as soon as they are rooted through or become somewhat pot-bound. Many propagators plant out the young plants from 3- and 4-in. pots into cold-frames after the middle of May, or when all danger of night frost is past. They do very well in the bright, hot, open sun, but must receive plenty of water. After being planted out in frames, they should be potted not later than September, and for early marketing as early as in August. The plan of planting out and potting in the later part of summer or early autumn is a very practicable one, as the plants do not suffer so much from the severe heat during the summer. H. A. Siebrecht.

Within recent years a much-branched or tree-shaped style of Rubber Plant has attained a considerable degree of popularity. It is possible to produce such a plant by topping it at any desired height while it is in a free growing condition. However, the best shaped plants are obtained only by natural branching. In order to induce Rubber Plants to branch freely without the intervention of topping, it is necessary to keep the plants dry and cool for two or three months in the spring, in order to get them thoroughly rested. Then plant them in a frame or in open ground that has been highly fertilized, and give plenty of water. When the plants start into growth they will be inclined to "break;" that is, to make branches from the axils of many of the leaves all along the stem. By this method handsome, tree-shaped specimens of the Rubber Plant may be secured by the following autumn. W. K. Harris.

FIG is *Ficus Carica*, a native of Asia. See *Ficus*. It is a warm-temperate fruit, although it will stand 10 to 20 degrees of frost under favorable conditions. It was early introduced into North America, but excepting on the Pacific coast it has never been more than an amateur fruit. It has been known to fruit in the open in Michigan without other protection than a high board fence inclosure, but usually if grown north of Philadelphia the plants are lifted in early November, with good balls of earth, kept in a dryish cellar over winter, and planted out the next spring. From Philadelphia to the Carolinas they may be bent to the ground and covered with earth or pine boughs. The fruit is borne on the young wood, and often on young trees. This fruit is really a hollow pear-shaped receptacle with many minute seeds (botanically fruits) on the inside; it grows like a branch from the side of the shoot. Inferior, run-wild forms are frequent in the southern states, where they are sometimes called "old man and woman" by the negroes. Figs may be grown under glass, being planted permanently in a border after the manner of hothouse grapes. They usually bear better if the branches are trained more or less horizontally. Two or more crops may be expected in one year under glass. Eastern nurserymen sell Fig trees. As early as 1833 Kenrick ("New American Orchardist") described 23 varieties. Popular varieties for amateur cultivation in the east are Turkey, White Genoa, Black and Brown Ischia. In order to facilitate the ripening of the fruit in cool climates or under glass, it is a custom to dress the surface of the nearly full grown Figs with sweet oil. As a dessert fruit Figs are usually eaten in the fresh state, in which condition they are scarcely known to people in cool climates. They are also cooked. The commercial Fig is the dried fruit.

The Fig is propagated very easily from hardwood cuttings, as grapes are. Take cuttings in the fall, cutting just below a bud. If wood is scarce, single-eye cuttings may be used, being started preferably in a frame. From cuttings, bearing plants may be expected in 2 to 4 years. New varieties are obtained from seeds.

Various fruit books give directions for the growing of Figs. Publications in California and of the United States Department of Agriculture discuss them. But the only independent American writing seems to be James T. Worthington's "Manual of Fig Culture in the Northern and Middle States," Chillicothe, Ohio, 1869. Although regularly copyrighted, it is a pamphlet of only 10 pages. It recommends the laying-down of the trees in late fall and covering them with earth. This practice gave better results than covering with other material, or carrying the trees over winter in cellars, either in tubs or transplanted from the open.

Incident to the commercial cultivation of Figs in California, there has been much discussion of the necessity of caprification or fertilization by means of the Fig wasp. The necessity for caprification, as well as the nature of the process, was first established by Dr. Gustav Eisen; see "Biological Studies on Figs, Caprifigs and Caprification" (Proc. Cal. Acad. Sci. Ser. 2, Vol. V. 1896). In this paper Dr. Eisen demonstrates for the first time that there are three distinct classes of edible Figs, those which here have been termed Smyrniaca, Hortensis and Intermedia, and that some of these required caprification and others not. Another point established by him was that caprification was entirely a process of pollination, and not due to the sting of the Fig insects, as had been previously held by certain investigators. In this and other Fig work, the United States Department of Agriculture has taken an active part. Dr. Howard, U. S. Entomologist, has done much towards introducing the wasp. As early as 1890, H. E. Van Deman, then U. S. Pomologist, introduced a few cuttings of the Smyrna Fig and large quantities of the Capri, and these were distributed in the Fig-growing sections of the country. The Smyrna Fig was first hand-pollinated in 1891 by

Dr. Eisen at Niles, Calif. The wasp was introduced several times without success, but the Department of Agriculture took hold of the matter in 1898, and in 1899 succeeded in establishing the insect (sent from Algeria by Mr. Swingle) in Mr. Roeding's orchard at Fresno, Calif.

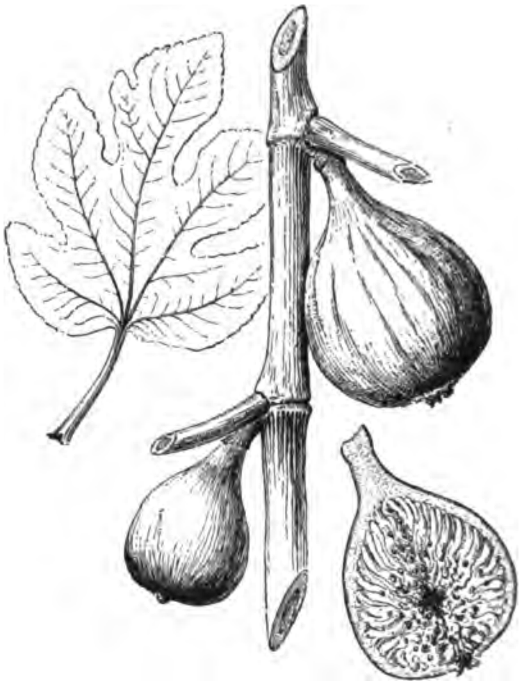
For further notes on Figs, see Bulletin No. 5, Division of Pomology, U. S. Dept. of Agric., by Gustav Eisen (1897), Bulletin 20, new series, Division of Entomology, Dept. of Agric., and various California writings. A recent full account of Smyrna Figs, by J. Burtt Davy, is in the Pacific Rural Press, Nov. 25, 1899. L. H. B.

Fig Culture in the Carolinas.—Enthusiasm in regard to Fig culture in the eastern part of the country has been very much dampened by the two or three severe winter spells of late years. Several methods of winter protection have been tried. A plan, which was so successful in northern Maryland, of bending them down and mounding with earth, will not do in North Carolina and southward. If the soil froze up and remained frozen, as it does in northern Maryland, it would be all right. But here there is more warm than cold weather in winter, and during the warm and wet spells the buried branches simply rot, and are worse off in the spring than those to which no protection is given. In normal winters most varieties of Figs get along very well without protection, but when the mercury drops to 10° or 12° above zero, even if the wood escapes, the early crop is destroyed. When the trees are branched in bush form from the ground, the best protection here is to bend them down to the ground and cover thickly with green pine boughs. If in standard shape and kept pruned so, the best method of all is to thatch the entire tree with corn stalks and broom sedge, placing a thick layer of corn stalks upright around the body of the trees, and tying them in closely at the top and banking the earth up against the butts, and then to thatch every limb separately with broom sedge, tying as we go. The trees come out in better shape from this than from any other mode of protection. There is a great deal of difference in the natural hardiness of the different varieties. The Celestial is one of the hardiest. Doree Narbus is reputed the hardiest in California, but was killed outright here. Next to Celestial comes the Brown Turkey, the Brunswick and Pegustrata. Adriatic is too tender to be of any use in North Carolina. Station Smyrna, from the California Station, seems to be almost as hardy as the Celestial. A few years ago Brown Turkey Figs were plentiful in the Raleigh market at 75 cts. per bushel, but for two or three years past hardly any have been offered. W. F. Massey.

Fig in California.—The Fig, a native of southwestern Asia, is one of the most ancient, beautiful and valuable of all fruit trees, and its more general culture in suitable districts of the United States is much to be desired. There are several recognized botanical varieties of the Fig (*Ficus Carica*), of which the following can be noted: (1) *Ficus Carica*, var. *sylvestris*, the wild Fig of Asia Minor, commonly called the Capri Fig. The fruit of this kind is not edible, but the little Fig wasp (*Blastophaga psenes*) breeds therein. (2) *Ficus Carica*, var. *Smyrniaca*, the true Smyrna Fig, which does not mature its fruit unless the flowers are cross-pollinated by hand or by the friendly agency of the Blastophaga, which pollinating is termed caprification. (3) *Ficus Carica*, var. *hortensis*, the common Fig of gardens and orchards. (4) *Ficus Carica*, var. *intermedia*, a type of Fig which matures one crop, but needs cross-pollination for the main, or second crop.

The last three of the above four botanical varieties of Figs, especially the third, have become the parents of many horticultural forms. The best drying Figs of commerce belong to the second class, *Smyrniaca*, while nearly all of the fine table and preserving sorts are varieties of *hortensis*. Nearly all cultivated varieties of Figs yield three crops, more or less distinct according to the variety, the location and the season. The second crop is the important one, but the first crop in some varieties is much esteemed for table use. Ripe Figs can be gathered in many California Fig orchards from late in July until rains and frost destroy the fruit.

Figs have been grown on the Pacific coast for much more than a century. Trees were probably at Loreto Mission, Lower California, before 1710, and reached the Alta California Missions soon after their establishment. Vancouver found Fig trees at Santa Clara in 1792. At the present time the Fig is cultivated in almost all parts of the state of California. The tree stands a range of temperature of from 18° to 120° Fahr., and the only portions of California really unsuited to its growth are certain cold or foggy districts. In the drier parts of the state it needs irrigation, as do other fruit trees. Some of the old Fig trees in California are of immense size. It is not uncommon to see trees with trunks of more than 2 feet in diameter. One tree in Stanislaus county is 60 feet in height, covers a circle 70 feet across, and has a trunk that girths 9 feet. The great Banyan-like Fig tree at General Bidwell's, Butte county, illustrated in the Century Magazine for October, 1892, has trailing or descending branches, which have taken root at many places, and the whole group now covers a circle more than 150 feet in diameter.



821. White Adriatic Fig

Varieties.—There are many horticultural varieties of the Fig, probably not less than 150 distinct sorts in cultivation under innumerable synonyms. Their classification is by shape, color of skin and color of flesh. The shape is round or turbinate in some sorts; pyriform or obovate in others. The skin varies in color in different varieties from green, through pale yellow, buff, light brown, reddish brown and purple, to black. The flesh is almost white, opaline, or various shades of red; it can be described as melting, spicy, juicy, coarse or even dry in a few old sorts which seem but a few removes from the wild. The size varies from sorts hardly as large as a green-gage plum to others that sometimes weigh 4 or 5 ounces apiece. The Fig most often planted in California came from the old Missions, and is known as California Black, a hardy and very productive sort. Properly dried it is an excellent Fig, but the dark color renders it less marketable than the white varieties. It is a very popular table Fig. The white Fig most generally planted in California is the so-called "White Adriatic," which is the "Grosse Verte" of France and the "Nebian" of Hogg. The best dried Figs yet produced commercially in California are of this variety, which does not need caprification. There is a large and increasing demand for California dried Figs, which are not yet equal in quality to the Smyrna product, but can be sold at a lower price.

The following 25 varieties of Fig are now freely cultivated in California, and extensively grown by the nurseries: Adriatic (Grosse Verte), Agen, Angelique, Black Ischia, Black Marseilles (Black Provence or Reculver), Bourjassote Blanc, Brown Turkey, Brunswick, California Black, Capri, Celeste (Celestine), Col di Signora Nero, Drap d'Or, Du Roi, Grossale, Ladaro, Negro Largo, Ronde Noire, Ronde Violette Hative, Royal Vineyard, San Pedro, Smyrna, White Genoa (Grosse Marseilles), White Ischia, White Marseilles (Petite Marseilles). The California Experiment Station has grown at various places the above 25 varieties, and, in addition, about 35 others, thus testing a collection of some 60 sorts, and these have been widely distributed for 6 or 8 years. The list includes Abondance Precoce, Brianzola, Black Brogiatto, Bellona, Bordeaux, Brown Ischia, Dalmatian, Doree Narbus, Rocardi, Rubrado, Verdal Longe, 3 varieties of Smyrna, Osborne Prolific, Pastiliere and an especially fine variety, Hirta du Japon, a medium-sized, turbinate, dark purple Fig with yellowish white flesh and high quality. This last named variety, with Angelique, Early Violet, Brown Turkey and a few others, is excellent for house culture or forcing. The best sources in France, Spain and Italy have been drawn upon for the various importations of Figs upon which these collections are based.

Acreage.—About 5,000 acres of land in California have been planted in Figs, mostly in small tracts seldom exceeding 20 acres. The leading Fig counties, as far as area is concerned, are Los Angeles, Santa Barbara, San Bernardino, Butte and Fresno, but the counties of Alameda, Santa Clara, Solano, Sacramento, Stanislaus, San Joaquin, Placer, Yuba, El Dorado and Shasta contain some of the finest groves and specimen trees.

The Smyrna Figs.—After many attempts, the true Smyrna Figs were introduced on quite an extensive scale by the San Francisco Bulletin in 1882, by the late James Shinn, and by George Roeding, of Fresno. From these different importations, California became well stocked with both the Capri and Smyrniaca types. The Fig wasp was obtained in July, 1891, by James Shinn, but the locality was unsuited to its propagation. It was again introduced at various times by the United States Department of Agriculture and by Mr. Roeding, until it now seems to be fairly well established at Fresno. The Smyrna Fig was first hand-pollinated in 1891 at Niles and also for several seasons at Fresno, producing Figs which when dried were of superior quality. In 1899 Mr. Roeding's Smyrna Figs, caprified by the little Fig wasp, bore a Fig crop. Several large orchards of the true Smyrna Figs, in various varieties, and many Capri Fig trees are ready for colonies of this useful Blastophaga, and it is hoped that a new industry can now be developed in various parts of California.

Propagation.—The Fig grows very readily from cuttings. Use well ripened wood of the previous season's growth, cut at the joint, and give them the same treatment required for grape cuttings. They will even grow from single-eye cuttings. Bottom heat is not necessary in California, where the cuttings are set in the nursery in December or January, and are ready for the orchard in a year. In the eastern states, winter-made cuttings can be started with bottom heat, or in the open air in April.

Budding is best done by the annular or ring method so useful for the chestnut and walnut. The Fig can be cleft-grafted, say in February in California, but extreme care must be taken to exclude the air. Seedlings are easily grown from the fertile seeds of the imported Smyrna Figs, and from the few fertile seeds occasionally appearing in common varieties.

Planting, Culture, etc.—The Fig tree in California requires much space, hence it is used as an avenue tree, or if in orchard form other trees are set between, to be afterwards removed. In good soil Fig trees, like walnuts, should finally stand not less than 40 feet apart.

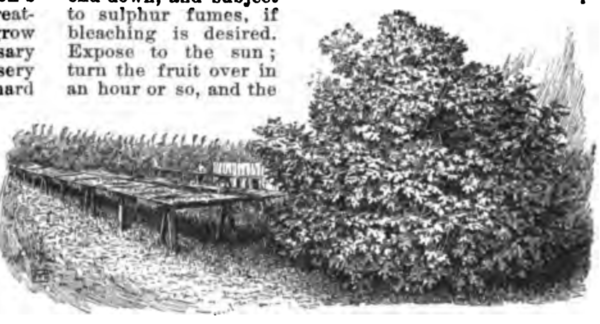
Little pruning is required for the Fig. Trees grown for table Figs are headed low, about 18 inches from the ground, to facilitate picking. Trees grown for drying Figs are headed higher, so that the ground can better be kept smooth and clean, for the Figs are usually allowed to ripen and fall. Cultivation is necessary until the trees completely shade the ground.

Figs begin to bear early in California, often the second or third year. Some trees prove barren, or very poor bearers, and must be replaced by others. Cuttings for propagation should always be taken from well-matured wood of bearing trees. The tree appears to be as long-lived as the olive, has very few insect enemies, and is not subject to disease. The fruit in some districts in some seasons ferments on the trees ("Fig-sour"). This sometimes seems to come from over irrigation, sometimes from lack of vitality, and more often occurs with very juicy and tender varieties.

Caprification.—The problems connected with Fig caprification have long been discussed, and the necessity for the process has been strenuously denied by many writers. But there is no doubt that Figs of the true Smyrna type cast their Figs unless caprified, for old trees are now growing in California and bear no crop. Cases otherwise reported prove to be of some different, or *hortensis*, variety. Fig caprification has been discussed in various papers in the publications of the State Board of Horticulture, by Dr. Eisen and others, in the publications of the Divisions of Pomology and Entomology, at Washington, and by W. T. Swingle in Science, October 20, 1899.

The true Smyrna Figs, which are of several varieties, and doubtless capable of much improvement, yield two crops, the first of which fails, because no pollen is then obtainable from the wild or Capri trees. Both earlier and later varieties of wild Figs than we now have are needed by horticulturists. The wild Fig now produces three crops, but only one is useful for caprification; the others are barren of pollen, but are necessary to maintain the Fig wasp. Only 30 Capri Figs are needed to caprify a large Fig tree, so abundant are the insects and the pollen in good seasons, and one tree of the wild Fig is sufficient for one hundred Smyrna trees. The male of the Fig wasp is without wings, but the female has wings and saw-like mandibles; she cuts her way through scales which interlock over the apex of the half grown Smyrna Fig. She loses her wings in entering, dies in the Fig, and is absorbed by the vegetable cells; if her eggs are deposited they also perish, and the continuance of the species depends upon those individuals that remain upon the wild Fig trees. The whole story is one of the most interesting known to entomologists.

Fig-drying in California (Fig. 822).—The foreign methods so far as tested in California are not practicable under labor conditions, and not entirely satisfactory in any case. Some growers let Figs fall from the trees, picking such as shrivel on the trees without dropping; others let all the Figs fall. Picking is best with the finer sorts. Allow the Figs to shrivel on the trees; pick with great care, place on slat trays, bloom-end down, and subject to sulphur fumes, if bleaching is desired. Expose to the sun; turn the fruit over in an hour or so, and the next day begin to "Fig-pull," or press each Fig between the fingers to keep it from "drying hard." In 4 or 5 days the Figs can be placed in the shade, and in a day or two "dipped" in boiling water, to further reduce the coarseness of the skin, close the pores and color the fruit.



822. Young Fig tree, and Fig-drying in open air. California.

Subsequent sweating and "processing" vary much as with prunes, raisins and other dried fruits. Exceeding care, cleanliness and long experience are all-important in the production of a high-grade article.

The dried Fig crop of California is large, and increasing. In 1886 the total product was but 100,000 pounds. In the 5 years ending with 1899 it was 14,945,000 pounds, an average of 2,989,000 pounds per annum. White Adriatic, Black Californian and to a small extent White Marseilles were the varieties producing this amount.

Culture in the eastern states.—The culture of the Fig in the northern and middle parts of the United States is extremely interesting, but is essentially different from California methods, or even from those prevailing in the southern states. The tree is not hardy enough to endure the climate excepting when grown as a bush, and protected in winter, usually by covering it with several inches of soil. In the southern middle states a heavy covering of straw or of evergreen branches is often sufficient. The first crop of fruit is all that can usually be expected in the extreme north; the second crop sometimes ripens in the middle states.

South of Virginia, many varieties of Fig are readily grown in the open ground. The experiments of Berckmans, Massey, Normand, Reasoner and others plainly show that the Fig is well adapted to a large area of the southern states, but chiefly for table use—not for drying, which seems to require a less moist summer atmosphere. The Fig cannot be carried far to market in a fresh state, and therefore its extended cultivation to supply local demands will long be profitable. Even in California the fruit markets are with difficulty kept supplied, and many large towns seldom have fresh Figs on the stands. CHARLES H. SHINN.

FIG. **Adam's F.** is *Musa paradisiaca.* **Barbary F.**, *Opuntia vulgaris.* **Devil's F.**, *Argemone Mexicana.* **Hottentot's F.**, *Mesembryanthemum edule.* **Indian F.**, *Opuntia vulgaris.* **Keg F.**, *Diospyros Kaki.* **Pharaoh's F.**, *Sycomorus antiquorum.*

FIG-MARIGOLD. *Mesembryanthemum.*

FILAGO Germanica, the COTTON ROSE, is a cottony annual plant somewhat like Leontopodium, which is now and then collected by tourists and dyed like immortelles. It was called *Herba impia* by the old herbalists, because a new generation of clustered heads rises out of the parent cluster as if undutifully exalting itself. Fully described in botanies.

FILBERT. Old World species of *Corylus.*

FILIPÉNDULA. See *Ulmaria.*

FINGER GRASS. Species of *Chloris* and *Panicum.*

FIORIN. *Agrostis stolonifera* and *alba.*

FIR should not be used to mean anything outside the genus Abies, but popularly it includes many trees known to nurserymen and others as Picea. Fir is also used loosely and inaccurately to include conifers of other genera.

FIRE-CRACKER, FLORAL. See *Brevoortia.*

FIRE-ON-THE-MOUNTAIN. *Euphorbia heterophylla.*

FIRE-PINK. *Silene Virginica.*

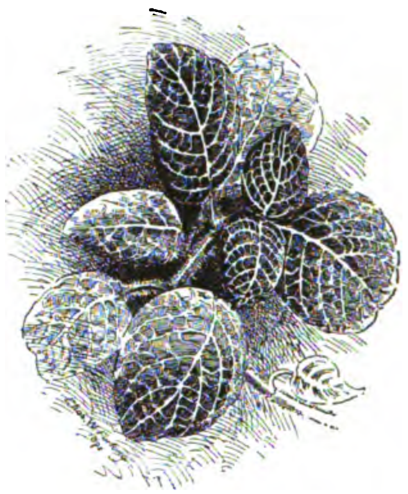
FIRE-PLANT is *Euphorbia heterophylla.*

FIRE-WEED. *Epilobium angustifolium* and *Erechtites hieracifolia.*

FISH-GRASS. See *Cabomba.*

FITTÒNIA (Elizabeth and Sarah Mary Fitton, authors of "Conversations on Botany," and friends of Robert Brown). *Acanthàceæ.* Three species of low-growing Peruvian herbaceous perennials, valued for the brilliant variegation made by red or white venation of their large, heart-shaped lvs. Fls. borne singly in the axils of the overlapping bracts, which form a peduncled, terminal spike; calyx segments linear-bristly; corolla tube slender; lip long, narrow, shortly lobed at the apex.

Fittonia argyroneura (Fig. 823) and *F. Verschaffeltii* are among the showiest and most satisfactory of tropical trailing plants that are grown for their foliage. Heat, moisture and shade are the main factors in their culture. They are standard plants in all the finer collections, and require a closer atmosphere than that of the ordinary living room. They are chiefly grown in wide, shallow pans on wire frames filled with moss and peat, some sand, and a little very finely rotted manure. They can be trusted with the most conspicuous position, as they are always on dress parade. They look well on a corner, with the pan tilted up somewhat so that some of the foliage may hang down. It is a good plan to place the pan on a small inverted saucer in a large saucer of water chiefly for the sake of a continuous supply of moisture, but also to foil the slugs, which are about the only enemies of these fine plants. A fine, large specimen can be quickly and easily secured by the use of a number of small plants. As fast as they grow they can be pegged down in their porous rooting medium. If a specimen has to be neglected for a long while it can be quickly renewed by covering with a little soil the bare portions of stem and pegging them down.



823. Fittonia argyroneura (×¼).

Fittonias are also amongst the finest elements in "pyramids" or mounds along with Philodendrum, *Cissus discolor*, *Episcea cupreata*, Nephthytis and Selaginellas. There is often a bare, unsightly space under the benches that can be transformed into a tangle of tropical creepers by the use of such plants. A board can be placed slanting toward the walks and covered with rotten stumps, chunks of peat, and moss for the plants to run in. The open borders near the walks have hardly good enough drainage. They can also be pegged down in mossy coverings for tubs of palms, as they can stand unlimited watering. On the whole, they are ideal plants for tropical conservatories, and it would be hard to overstate their merits.

A. *Habit erect: height 1½ ft.*

gigantèa, Linden (*Gymnostàchyum gigantèa*, Hort.). Subshrubby, branching: stems reddish violet only between the joints, with 4 ranks of silky, white, erect hairs: lvs. opposite, elliptical, not notched at the base, with 2 ranks of hairs, tapering more than in the other species, dark, shining green; veins carmine-red: fls. pale, with a reddish brown band in the middle of the side and upper lobes, and a dark yellow spot in the middle of the lower lip. R.H. 1869, p. 186. I.H. 16:611.

AA. *Habit trailing: height about 6 in.*

B. *Veins red.*

Verschafféltii, E. Coëm. (*Fittonia* and *Eranthemum rubronervum* and *rubrovenosum*, Hort. *Eranthemum* *rubro-venium*, Veitch. *Gymnostachyum Verschaffeltii*, Lemaire). Lvs. ovate, notched at the base, dull green, often yellowish, veined carmine. F.S. 15:1581. I.H. 10:372. Var. **Pèarcei** (*F.* and *G. Pèarcei*, Hort.). Lvs. light, bright green; veins light, bright carmine; under surface somewhat glaucous. Var. **Dàveana** (*F. Dàveana*, Hort.). Once sold by J. Saul. "Foliage with light center, bordered very dark green." More robust than the type and with veins of stronger red.

B. *Veins white.*

argyroneùra, E. Coëm. Lvs. dark, shining green. F.S. 16:1664. Gn. 36, p. 527, and 2, p. 319.—The velvetiness of the upper surface of *F. Verschaffeltii* is due to large, projecting epidermal cells with an apical nucleus. Instead of these characteristic cells, *F. argyroneura* has small cells and conical hairs, which are partitioned off and have tubercles at the base.

ROBERT SHORE and W. M.

FIVE-FINGER. *Potentilla.*

FLACOÚRTIA (Etienne de Flacourt, 1607–1660, General Director of the French East India Co., Governor of Madagascar and author of a history of Madagascar). *Bixàceæ.* This genus contains a spiny hedge and fruit plant called the Rambustan or Governor's Plum. It is a dense-leaved plant with purple fruits, grown only in S. Calif. The whole order, with its 29 genera and 160 species, contains no plants of garden value except a few Azaras and *Aberia Caffra*, another tropical spiny hedge and fruit plant. Lvs. short-stalked, toothed: fls. small, diœcious, in small racemes or glomes; sepals 4–5, scab-like, ciliated, overlapping; petals none; stamens many; styles 2 to many: ovary 2–5-celled: fr. a berry. In Aberia the sepals scarcely overlap. *F. Ramontchi*, L'Hérit., the Governor's Plum, comes from India, Malaya and Madagascar.

F. FRANCESCHI and W. M.

FLAG, *Iris.* **Cat Tail F.**, *Typha.* **Corn F.**, *Gladiolus.* **Sweet F.**, *Acorus Calamus.* **Yellow F.**, *Iris Pseudacorus.*

FLAME-FLOWER. *Kniphofia aloides.*

FLAX. As fiber plants are treated only incidentally in this work, the reader is referred to certain publications of the Department of Agriculture. Report No. 10 of the Office of Fiber Investigations contains 80 pages, published in 1898. Farmers' Bulletin No. 27, published 1895, is a summary in 16 pages. Another summary may be found in the Year Book for 1897. Flax is occasionally cult. for ornament, and is therefore described under *Linum.*

FLAX, False, is *Camelina.* **New Zealand F.**, *Phormium tenax.* **Toad F.**, *Linaria.*

FLEABANE. *Erigeron.*

FLEMÍNGIA (John Fleming, Pres. Medical Board of Bengal; author of "A Catalogue of Indian Medicinal Plants and Drugs"). *Leguminòsæ.* This genus includes two shrubs, cult. only in S. Calif. and S. Fla. Herbs, subshrubs or shrubs of the Old World tropics, erect, prostrate or twining: lvs. mostly with 3 digitate leaflets, rarely 1; stipules none: fls. red or purple and mixed with yellow, in crowded racemes or panicles; stamens 9 and 1: pod short, oblique, swelled, 2-valved: seeds spherical.

congésta, Roxb. Shrub, somewhat erect: lfts. broadly lanceolated, the side ones 2-nerved, middle one 3-nerved: racemes axillary, dense, shorter than the leaf-stalks. India. "Rich, ornamental foliage: fls. purple."—*Franceschi.*

F. strobilifera, R. Br., has been introduced recently in S. Fla. It has drooping fascicles of white pink-striped fls. and large yellow bracts: lvs. simple, ovate, acute: plant shrubby.

FLOATING HEART. *Limnanthemum.*

FLORA'S PAINT BRUSH is a common name for *Emilia flammea.*

FLORICULTURE. The cultivation of plants for ornamental purposes is known as Floriculture. The work is limited largely to herbaceous or small plants, and is confined for the most part to greenhouses and other glass structures. In this country Floriculture did not assume much importance until about 1825. Prior to that time a number of firms were devoting considerable attention to the work, but their field was so broad that they could hardly be called florists. After the year named, affairs generally were in a more settled condition, and there began to be a marked increase in all lines of business. The eastern states were rapidly increasing in population and wealth, especially near Boston, New York, Philadelphia, Baltimore and Washington, and with this increase came a demand for flowers.

Philadelphia was one of the first cities in which Floriculture assumed importance. This was due to the fact that a great deal of wealth had accumulated there, and the people therefore had time and opportunity to cultivate a love for the beautiful in the shape of flowers. Philadelphia had advantages also due to climate and to the active work of several horticultural societies which were organized early, and did much to extend the interest already awakened. Boston was also a center for Floricultural work, and many fine establishments were located in that vicinity. New York was behind most of the other cities, largely because the time of her people was very fully occupied with business affairs.

From 1830 to 1840 much progress was made in all branches of the work. Rapid improvement in greenhouse construction had been brought about, and many facilities were afforded growers for heating and ventilating their greenhouses, which materially aided in the production of better stock. The change from flues to hot water was the most important innovation of the period. About 1850 other improvements which had a marked influence on the industry were made in greenhouse construction. Chief among these may be mentioned the abandonment of movable sashes and the substitution of fixed roofs, the use of larger-sized glass, and the bedding of the glass in putty instead of placing the putty on the outside. These improvements may appear trivial at the present time, but they marked an important advance in greenhouse construction. In those early days the principal plants grown for cut-flowers were camellias, tuberoses, heliotrope, bouvardias, etc., and for bedding and for ornamental and other purposes, fuchsias, geraniums and bulbs of various kinds.

By 1860 commercial Floriculture had assumed considerable importance. The establishments in the main, however, were devoted to many diverse lines of work; that is, the commercial florists of the time were required, through the demands of the market, to grow not only cut-flowers, but also plants for ornament and for bedding. Things went on for the most part in this way until after the civil war, when there began an era of plant-growing, which continued until about 1868 or 1870. At this time plants of all kinds were in demand in preference to cut-flowers, consequently many new establishments were started, and these devoted practically all their space to growing ornamental stock. The rose, which had come into general use as early as 1850, was rapidly superseding the camellia. Carnations were also being grown to a considerable extent, and much attention was devoted to lilies and other bulbous crops, such as hyacinths, tulips, etc. About this time violets began to attract attention, and the introduction of the variety Marie Louise gave an impetus to the work which was destined to have a marked influence on an important phase of Floricultural development.

About 1870 there was a noted increase in the demand for cut-flowers, and in a short time this business assumed important proportions. Soon there was a rush to change from the growing of plants for ornament and for bedding to the forcing of roses, carnations and other crops for the flowers alone. This demand for cut-flowers had an important bearing on methods of culture and the construction of houses, and it was found necessary in many cases to modify existing methods and to change the construction to suit the demands of the time.

During the past twenty-five years the demand for cut-flowers has been constantly increasing, and, while the same is true of plants, the demand for flowers has been proportionally greater. As a result of the increasing desire for flowers, there have been developed methods of handling them which prior to 1870 were unknown. The best growers have found it necessary to specialize in order to keep pace with the demands of the trade for the highest grade of flowers, hence we have specialists in rose-growing, carnation-growing, violet-growing, etc. The immense number of flowers produced required special methods for handling, and therefore there have been developed wholesale commission houses, retail stores, exchanges, auction sales, and other arrangements for quickly disposing of stock. See *Cut-Flowers*.

As already pointed out, the industry has assumed the most importance near large cities, owing to the great demand in such places for both plants and flowers. The cities which now lead in the handling of stock of this kind are New York, Chicago, Boston and Philadelphia. The greatest amount of glass devoted to Floriculture is found in New York, Illinois, Pennsylvania and New Jersey, in the order named. There are now probably not less than nine or ten thousand floral establishments in the United States, representing a money value of from twenty-two to twenty-three million dollars, and giving employment to not less than fifteen thousand people. The annual output from these establishments, considered from the retailer's standpoint, is in the neighborhood of twenty-five million dollars. Of this amount from twelve to fourteen millions are annually spent for flowers and the remaining ten or twelve millions for plants.

The rose is the most important cut-flower grown, and there are not less than six million dollars' worth sold every year in this country. This means an annual production of fully one hundred million flowers. The carnation is the second flower in importance. It is estimated that there is sold annually fully four million dollars' worth of this flower, representing a production of not less than one hundred million flowers. The violet is third, with a production of seventy-five million flowers, valued at seven hundred and fifty thousand dollars. Chrysanthemums are only a part-year crop, but they represent a value of half a million dollars. Of miscellaneous flowers, such as lilies, hyacinths, tulips, orchids, etc., there are probably between two and three million dollars' worth sold annually. The varieties of roses, carnations and chrysanthemums grown for flowers are constantly changing, but the varieties of violets have changed but little in twenty years.

The number of plants sold, including palms, ferns and bedding stock of all kinds, will probably exceed one hundred millions, estimating that the average sized pot for the country as a whole is 3 inches, and the average price 10 cents per pot.

To properly conduct the fine retail establishments in our cities, a large force of employés is required. These establishments are carried on with every attention to methods for attracting and holding trade. The stores are models of elegance, and their methods of handling the crops, such as having special decorators, show windows, fine delivery wagons, messenger boys, etc., makes the business expensive.

As a rule, florists are such busy people that few of them have time to write books on their specialties, consequently the works on this industry can be counted on the fingers of one hand. The first work of importance was Peter Henderson's "Practical Floriculture," which was issued in 1867. New editions of this were issued from time to time, but nothing further was published until 1893, when M. A. Hunt's "How to Grow Cut-Flowers" appeared. More recently we have Taft's "Greenhouse Management," which covers the whole field of plant-growing under glass, and also the "Florists' Manual," by William Scott.

B. T. Galloway.

FLORIDA HORTICULTURE. Fig. 824. The history of Horticulture in Florida dates from the earliest settlements, and even prior to that period the aborigines carried on a desultory plant growing. The peculiarity of the soil, however, prohibited the extension of this work except in a few isolated places. It was necessary to introduce commercial fertilizers before Horticulture could make rapid progress in this state. Up to the time of commercial fertilizers, it was thought that the hammocks were the only places capable of raising fruit, the rest of the arable land being so sandy and wanting in plant-food that remunerative crops could not be grown on it excepting after it had been "cow-penned."

Such a soil, containing often over 90 per cent sand and insoluble matter, at first sight would seem to be absolutely worthless for Horticultural purposes, but with the advent of the new Horticulture it becomes the ideal soil. We have here a lodgment for plants in which occurs no material that will prove deleterious to the crop, and all we have to do is to add to it the material that will cause the plant to grow to the necessary size and produce fruit of the desired quality. Beautiful thin-skinned oranges grow only on land properly fertilized and not on soil impregnated with great quantities of organic nitrogen, i.e., fertile lands.

Circumscribed Areas.—In building up of the land from the ocean bed, referring especially to peninsular Florida, the wind and waves have sorted the particles to some extent and have elevated various portions more than others. The separation of the larger particles of sand from the finer, with a porous substratum, has produced what is called a "scrub." The railroad surveys indicate that the maxim elevation in peninsular Florida is about 150 feet. Thus it happens that, although this land is thirsty, it is rarely or never spent of its capillary moisture. The areas of scrubs may vary in size from a few acres or even less to many thousands, but they are always sharply defined, having a specialized flora. The soil in a hammock is of a finer texture and is not infrequently underlaid by clay. It often occurs that land of this texture is only a few feet above sea level, or it may be elevated and rolling, but is always covered with a good growth of hard wood or of cabbage palmetto, or both. This class of land has long been desirable for Horticultural purposes, and is still regarded as valuable; these regions are more or less isolated, and vary in extent. Such land usually contains sufficient fertility to raise several crops of vegetables. Flat-woods land is usually level, varying in fertility from 96 per cent of sand and insoluble matter to that which will produce a crop of tomatoes. This class of land comprises about nine-tenths of the land of the Peninsula. With proper treatment it raises good crops and is capable of remarkable improvement. The characteristic plant of this land is the long-leaved pine (*Pinus palustris*).

Horticultural Regions.—The foregoing discussion relates to the state independent of latitude and climate. The state is also divided into four regions, according to climate and latitude: (1) western Florida, that portion of the state lying west of the Aucilla river; (2) eastern Florida, that portion of the state lying between the Aucilla river and a line drawn from the mouth of the St. John's river to Cedar Keys; (3) central Florida, that portion of the state lying between eastern Florida and southern Florida; (4) southern Florida,—including the counties of Brevard, Dade, Monroe, Lee, DeSoto and Manatee.

Citrous Fruits develop best on hammock and flat-woods land, preferring the cabbage palmetto hammocks or a hammock containing a mixture of palmetto and hard wood. The lime (*Citrus Medicus* var.) alone does well on the shell and coquina lands of southern Florida. The lemon is the best stock for high flat-woods land. For western Florida the Satsuma orange is the best variety. For eastern Florida varieties that mature their fruit before Christmas may be planted. In central Florida all the varieties of Citrus do well, especially toward the south and in protected localities. The following sweet oranges do especially well in southern Florida: Centennial, DuRoi, Exquisite, Hart's Late, Higley's Late, Homosassa, Jaffa, Madam Vinoe, Majorca, Maltese Oval, Nonpareil, Parson Brown, Pineapple and Thorpe. Of the Mandarin group,—China, Cleopatra, Dancy's Tangerine, Japan Tangerine and King. Of the Bitter Orange group,—Phillips Bitter Sweet. Of the Pomelos,—Aurantium, Hart, Josselyn, Seedless and Walter. Of the Kin-Kans,—Marumi and Nagami. Of the Citron group,—Lyman, Lemon and Orange. Of Shaddocks,—Blood, "Forbidden Fruit" and Mammoth.

Peaches grow in all sections, preferring hammock or rolling flat-woods land or even level flat-woods land if perfectly drained, but the varieties best adapted to different regions vary considerably. Among those adapted to western Florida we have Alexander, Early Cream, Elberta, Florida Crawford, General Lee, Imperial and Powers' September. For eastern Florida,—Angel, Bidwell's Late, Colon, Ferdinand, Honey, Imperial, Oviedo, Taber, Triana and Waldo. For central Florida,—Angel, Bidwell's Early, Bidwell's Late, Maggie, Peen-to, Waldo and Yum Yum. For southern Florida,—Angel, Bidwell's Early, Bidwell's Late, Maggie, Peen-to, Yum Yum, and others.

Plums, as a whole, are adapted only to western and eastern Florida, preferring hammock and flat-woods land. Burbank does well in the western section. In the eastern section Babcock, Botan and Burbank do well.

Pears.— Kieffer, LeConte and Smith pears do well in western and eastern Florida on hammock or flat-woods land.

Grapes grow rapidly, but need careful attention to be kept in good bearing condition for a period of years. Hammock land is preferable for them. The native varieties grow to an immense size and produce great quantities of fruit with a minimum attention. Of *V. rotundifolia*, the Scuppernong and Thomas grow luxuriantly in all sections. Flowers grows well in western, eastern and central Florida. Of the true Vitis section of this genus, Cynthiana, Ives and Norton do well in western Florida; Cynthiana, Ives, Niagara and Norton do well in eastern Florida; Cynthiana, Niagara and Norton in central Florida.

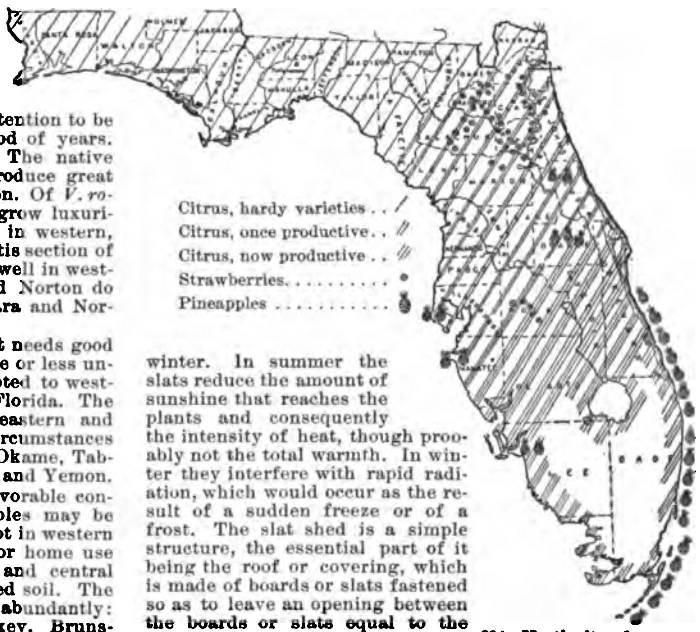
Kaki (Japanese Persimmon).—This fruit needs good hammock land or well drained high, or more or less undulating flat-woods land. It is better adapted to western, eastern and central than to southern Florida. The following varieties do well in western, eastern and central Florida, and under most favorable circumstances in southern Florida: Costata, Hyakume, Okame, Taber's No. 129, Tane-nashi, Tsuru, Yeddo-ichi and Yemon.

Miscellaneous Tree Fruits.—Under favorable conditions Jennings and Red Astrachan apples may be fruited in western Florida; Santa Fé apricot in western and eastern Florida. Figs do fairly well for home use and for canning or candying in eastern and central Florida. They need a compact, fine-textured soil. The following varieties fruit more or less abundantly: Black Ischia, Blue Genoa, Brown Turkey, Brunswick, Celestial, Green Ischia, Lemon and White Marseilles.

Mulberries will grow on hammock or good quality of flat-woods land in all sections of the state. The following varieties have given good crops: Downing, Hicks and Stubbs. Pomegranates make a more or less ornamental fruit. Acid, Purple and Sweet do well in western, eastern and central Florida. Pecans do best on low hammock land, especially in western Florida. They succeed well in eastern and central Florida, but have not been introduced into southern Florida sufficiently to permit definite statement.

Strawberries.—The growing of this crop is controlled largely by efficient and reasonable transportation. If the crop cannot be placed upon the market promptly it is worthless. The development of this industry is, therefore, coincident with that of efficient and reasonable railroad transportation. Probably nine-tenths of the fields of the state are planted on moist flat-woods land, or what is locally known as gall-berry flats. Such land is cleared and thoroughly drained by means of open ditches. On such land strawberries begin to ripen in January and continue until May or June if properly cultivated, though the season of profitable shipment rarely extends beyond the middle of April. Especially prepared refrigerator cars, so constructed that the ice tank is filled from the outside, the water melted from it carried off without entering the car, keeping the apartment occupied by berries dry and cool in transit, are now carried by some railroads on express trains. The plants are usually set out every year, in August, September and October, and bear a good crop the following spring. The most successful strawberry growers continue to cultivate a portion of the old field to secure new plants to be used the following fall for planting out the new field. Cloud, Newnan, Lady Thompson and Wilson do well in western, eastern and central Florida.

Pineapples find their most congenial habitat on scrub land. Soil from pineapple fields contains a large per cent of sand and insoluble matter,—as high as 98 per cent. The land must be well drained, free from any standing water, even during the rainy season. The most extensive pineapple area is located on the sand hills near the coast. The character of the vegetation and physical condition of these hills or dunes is essentially that of the scrub land of the interior. The slat sheds or pineapple sheds, which are constructed to afford a half shade, serve a good purpose in summer as well as in winter. In summer the slats reduce the amount of sunshine that reaches the plants and consequently the intensity of heat, though prooably not the total warmth. In winter they interfere with rapid radiation, which would occur as the result of a sudden freeze or of a frost. The slat shed is a simple structure, the essential part of it being the roof or covering, which is made of boards or slats fastened so as to leave an opening between the boards or slats equal to the space covered by them. These vary in size from a common plastering lath to boards 4 inches wide. The height of the covering above the ground varies from 6 feet to rarely more than 10. The most extensive fields are located in southern Florida. Smaller areas have been planted in central Florida; nearly all of these are protected by sheds, some of the sheds being so constructed that the roof may be closed completely. The islands or keys underlaid with coraline breccia form one of the most suitable habitats for this plant, while the low, fertile islands or keys are worthless for a pineapple plantation. Red Spanish is cultivated more extensively than all the other varieties combined. It is a hardy variety, and one suited to extensive planting with a minimum amount of attention. For extensive culture Egyptian Queen, Porto (Puerto) Rico and Ripley Queen do well generally. Smooth Cayenne is promising, because not spiny. The total amount of fruit produced annually varies considerably, but has probably not exceeded 100,000 whole barrel crates. This, however, is only a fraction of the possibility and probability of pineapple growing in Florida.


Citrus, hardy varieties . . /
Citrus, once productive . . //
Citrus, now productive . . ///
Strawberries. . . . . ●
Pineapples . . . .

824. Horticultural zones of Florida.

Bananas are cultivated only for local markets, but form a source of considerable revenue to a number of plantations. The land best adapted to them is a low, moist hammock or a bay head, especially such soil as is composed largely of muck. Baraçoa (Red Jamaica), Cavendish, Golden, Hart's Choice and Orinoco ("Horse Banana") are leading varieties in southern Florida.

Guava.—The guava has attained considerable importance, though as yet it is not cultivated extensively. Plantations exist in various portions of the state, but the greater quantity used in canning and for jelly is collected from uncultivated or from originally native growth. The native varieties grow well on any fertile soil that is well drained. Fertile soil on coral breccia is a favorite spot for the wild guava. The most desirable varieties are the common native guava, White Winter, Cattley and Chinese. The native varieties yield the bulk of the fruit used. The Cattley and Chinese do well in central and southern Florida, while the White Winter and native varieties grow to greatest perfection in southern Florida.

Mangoes have not been grown extensively for northern markets. The greatest difficulty has been that of securing trees of unquestionable value for setting out a grove. Since the difficulty in the way of grafting and budding has been overcome, the groves will multiply rapidly. Up to the present time the local markets have demanded more fruit than has been supplied them. Well drained first-class flat-woods land and fertile high hammocks furnish good soil for mangoes. Apricot and No. 11 (Apple) are favorite varieties. They are grown mostly in southern Florida, though fruited in southern portions of central Florida.

Cocoanuts are confined to southern Florida and along the seacoast. While the trees continue to grow when transplanted to the higher lands, they need the low, moist lands of the coast for fruiting and for highest development.

The **Avocado Pear** has entered the markets to some extent. The soil should be like that for mangoes. Their cultivation is confined to central and southern Florida.

Vegetables.—There are several classes of soils upon which vegetables are grown extensively; viz., hammock, flat-woods, the low islands around the coast, and the marl or drained lands. The low hammocks, especially those composed almost exclusively of cabbage palmetto, produce the largest crops and probably the largest profits, while flat-woods land is probably more extensively cultivated than any other. In a general way all the classes of land mentioned above are capable of growing most or all of the vegetables occurring in the markets. Certain vegetables show a general preference for certain classes of land. A high hardwood hammock grows beans, beets, cabbage, cauliflower, collards, eggplant, Irish potatoes, lettuce, watermelons, muskmelon, onion, okra, English peas, pepper, radish, squashes, rutabaga, tomato and sweet potato well; though first-class flat-woods land grows cabbage, cauliflower, eggplant, lettuce, watermelon, muskmelon, onion, tomato and sweet potato to greater perfection. Low cabbage palmetto hammocks grow beets, cabbage, cauliflower, celery, cucumbers, lettuce, nutmeg melons and tomatoes to best advantage. The low islands around the coast have areas varying in size from a few square rods to many acres in extent,—sometimes reaching a mile in length of unbroken rows. The most important crops grown on these islands are beans, eggplant, peppers and tomatoes. The marl or drained lands of the southeast coast raise principally tomatoes, peppers, eggplant and okra.

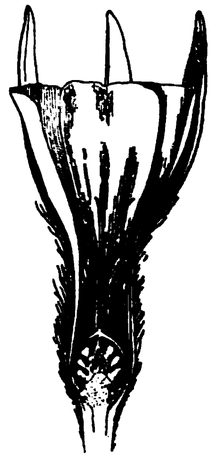
P. H. Rolfs.

FLORIDA ARROW ROOT. *Zamia integrifolia.*

FLORIDA SWAMP LILY. See *Crinum Americanum.*

FLORISTS' FLOWERS. This term is considerably used in England to include a group of plants that number their horticultural varieties by the hundreds, and in which the original species or types are no longer cultivated, or else cultivated merely for their interest as prototypes. The list includes 40–50 groups of plants, or even less. In America the term florists' flowers is little used, and is mostly restricted to certain cut-flowers of great importance to florists, without regard to whether their varieties are numerous or not. Thus, the calla lily, Easter lily, heliotrope, lily-of-the-valley, Marguerite, mignonette, sweet alyssum and tuberose are of considerable commercial importance to florists, but they are not extremely prolific in varieties. Inasmuch as the cut-flower trade has been greater than the plant trade in America, the American florist hardly thinks of the following plants as florists' flowers: azalea, calceolaria, cineraria, fuchsia, geranium, gloxinia, pelargonium, primula, nor such old-fashioned favorites as *Anemone coronaria*, auricula, camellia, polyanthus and ranunculus. The English writers often speak of the dahlia as a florists' flower, and sometimes also the other very variable summer bulbs, as cannas, gladiolus, and perhaps lilies, though the American florists sell comparatively few flowers cut from these plants in summer. Of hardy border plants, the following are very rich in horticultural varieties: China asters, poppies, stocks, sweet peas, tropæolum and verbena (all of which are annuals), and the following perennials: hollyhocks, pansies, peonies, phlox, pyrethrum. Others of great importance are aquilegia, campanula and eschscholzia, but these are mostly less rich in horticultural varieties. It has been said that florists' flowers are always propagated by cuttings or other asexual parts, but this definition would exclude calceolarias and cinerarias, which come fairly true from seed. In America the four most important cut-flowers are the rose, carnation, violet and chrysanthemum. Consult *Floriculture* and *Cut-flowers.*

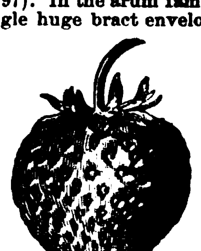
FLOWER: technically, a short stem carrying one or more specialized leaves which bear sporangia. The word is commonly applied to those flowers whose sporangial leaves are protected and made conspicuous by colored leaves. It is also popularly applied to these clusters of colored leaves even when the sporangial leaves are wanting, as in hydrangeas, snowballs, chrysanthemums and most "double flowers."


825. Section of a flower of Corn-cockle.
Showing torus, ovary, styles, stamens, and floral envelopes.

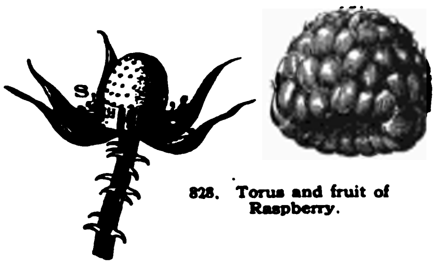
When most completely developed, a flower consists of the central short stem, the *torus*, to which the other parts (leaves) are attached. The leaves, passing from below upwards, are distinguishable into floral leaves, or the *sepals* and *petals*; and the sporangial leaves, or the *stamens* and *carpels*. The number of these parts is variable. When "double" flowers are produced, the floral leaves usually are multiplied at the expense of the sporangial ones. In Fig. 825 all these parts are shown. The ovary, showing six ovules, sits on the torus or receptacle. On the ovary are three styles. Stamens are at the side. The sepals rise above the petals.

Bracts.—The leaves growing on or near the branches of the flower cluster are usually different in form and size from the foliage; they are called bracts. Note the bracts on the carnation flower (Fig. 366). Sometimes they are bright-colored and are an attractive supplement to the flower, being popularly looked upon as a part of the flower, as in scarlet sage, flowering dogwood (Fig. 558) and poinsettia (Fig. 797). In the arum family (Fig. 79, 137, 146, 318, 734) a single huge bract envelops the entire flower-cluster. When the bracts grow very close to the torus they are almost indistinguishable from the outer floral leaves, as in the strawberry (Fig. 827) and hepatica (Fig. 834).

826. Flower of the Strawberry.
Showing the high torus in the center.


827. The ripened torus of the Strawberry.

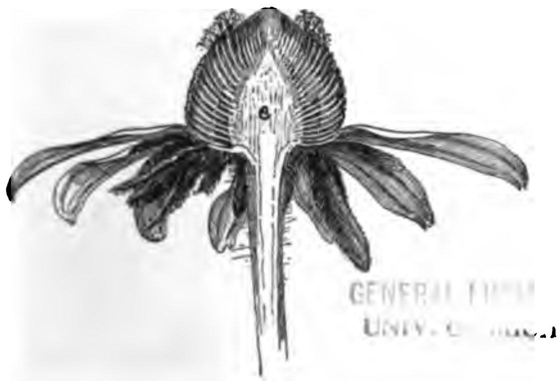
Torus.—The torus is the short stem or axis on which flower leaves are borne. It differs from other parts of the stem chiefly in that, after the rudiments of the flower leaves are formed, the intervening parts grow very little, and so do not separate the successive leaves or circles of leaves. The torus is more or less broadened or elongated to permit the suitable growth of the crowded leaves. In the strawberry it is high, dome-shaped (Figs. 826, 827); in the raspberry the torus remains (S, Fig. 828) when the little drupes are removed; in the rose it is urn-shaped, bearing the leaves on the edge and inner face; in the mouse-tail it is much elongated. When a number of flowers are crowded together their leaves are developed from a common torus, as in sunflower and chrysanthemum and other members of the Compositæ (Fig. 829). The common torus may be broad and flat, with the flowers scattered over it, as in Dorstenia (Fig. 732); or even hollow, as in the fig (Fig. 821), with the minute flowers on the nearly enclosed inner face.



828. Torus and fruit of Raspberry.

Floral leaves.—The leaves of the flower form two series; the outer protective and attractive leaves, the *floral leaves*, and the inner *sporangial leaves*. The floral leaves are usually distinguishable into an outer set, the *calyx*, and an inner set, the *corolla*. The calyx leaves, when separate, are called *sepals*, and the corolla leaves *petals*. The sepals are more or less different from the petals in size, shape and color. They are oftenest green, and usually smaller and simpler than the petals. In the bud they usually completely cover the inner leaves. The sepals and petals oftentimes do not remain distinct throughout their development, but each set grows as a single piece; a fact which has been made the basis of classification of the angiosperms. Corollas of a single piece are said to be gamopetalous (Fig. 830). The sepals are more commonly inseparate than the petals.

The apparent union of the floral leaves comes about generally in this way: On the young torus the rudiments of the sepals and petals arise as rounded knobs, which for a longer or shorter time grow independently. If they develop independently until their growth ceases, the sepals or petals are distinct, each one being separately attached to the torus. On the other hand, after the leaf rudiments have grown independently for a time, a zone of the torus, both under and between two or more adjacent rudiments, may begin to grow, lifting them on its margin. In that case, when fully grown the calyx or corolla appears as a single piece, whose free edge is more or less deeply lobed, according to the relative duration of independent development of the rudiments.



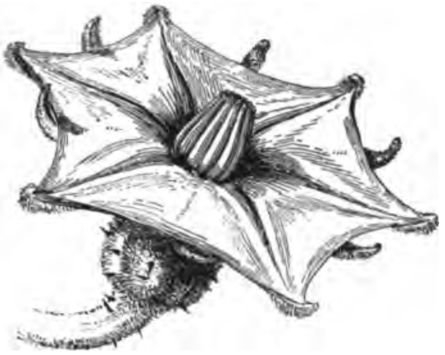
GENERAL LIBRARY UNIV. OF MICH.

829. Section of a compositous head. Showing the common torus at *e*.

The calyx and corolla are sometimes united. This comes about in a similar way. Each begins to develop independently; later the tissue between calyx and corolla shares in the growth and both are raised on a common base.

The form of the mature floral leaves depends largely on the relations of the flower to insects, which visit the flowers for nectar or pollen. The floral leaves are often irregular and unequal, so as to form suitable landing places, nectar glands, guides to the nectar, etc.,—all devices to facilitate the proper transfer of pollen by the visitors; e. g., the sweet pea and other papilionaceous flowers, most orchids, etc. (see *Pollination*).

The color of the corolla and adjacent parts is due to the presence in the cells of colored sap or special color-bodies. In the latter case the pigment is sometimes crystalline. It is not possible to determine without microscopic examination in which way the color is produced. Most blues are due to colored sap; many yellows and reds to color-bodies.



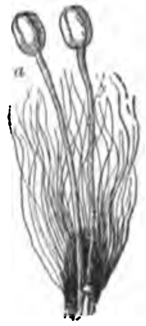
830. A gamopetalous corolla of Eggplant.

The velvety appearance of many petals is produced by the outgrowth of the surface cells into conical or dome-shaped protuberances.

The odor of flowers is usually due to the presence of volatile oils in the surface cells of the petals or sepals, or both. These oils are present in small amount only. They are sometimes found only on the outer face, or only on the inner face, or they may even be restricted to certain lines or patches.

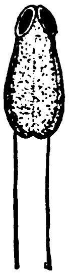
The stamens.—The stamens commonly consist of two parts, a stalk, the *filament*, bearing a larger portion, the *anther* (Fig. 831). The filament is usually rigid enough to sustain the weight of the anther, but at maturity it is sometimes so long and slender that the anthers hang as by a thread (so in grasses). The filament is sometimes so short as to seem wanting; the anther is then said to be sessile. The filaments are often united with one another or with the corolla by the mode of growth already described. In the latter case the stamens seem to arise from the corolla. Only rarely are the stamens and carpels united.

The anther is the part of the stamen which bears the spore-cases or pollen sacs (sporangia). (The sporangia are not always borne on stamens. In a few plants they are sunk in the stem of the flower.) Of these there are commonly four, more rarely two or one. When the anther was looked upon as a chambered body, the sporangia were called thecæ, or cells. Thus in descriptive botany the anther is said to be "2-celled" or "4-celled." The sporangia are partly free and partly imbedded in a mass of tissue



831. Staminate flower of Willow. Showing two stamens; their anthers are at *a*.

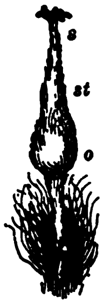
which joins them, called the *connective*. This sometimes is extensive, and in a few plants is developed into peculiar forms to aid in pollination, e. g., in salvias.



832. Anther of Azalea.

Showing dehiscence by pores.

The sporangia at maturity consist of two or four (rarely more) layers of cells, constituting a wall, surrounding a quantity of spores, the *pollen*. The inner portion of the wall consists of a layer of cells whose membranes are irregularly thickened, usually in bands, so that in drying they warp the wall, rupturing it at the weakest place. The lines of weakness are usually definitely localized, so that each anther breaks in a regular way. (*a*) The rupture may run along the whole length of the anther. In that case it commonly lies at the junction of a pair of sporangia (the left-hand groove in *a*, Fig. 831), which become confluent, so that the dehiscent anther may seem to have only two sporangia, when it really has four. The pollen is thus emptied out practically at once, though the break may begin at the top and progress to the base. Examples: lilies, grasses. (*b*) The slit may be very short and gape widely, so that a pore is formed through which the pollen is gradually sifted (Fig. 832). Examples: the heaths. (*c*) In some plants the line of breakage is curved, and the flap, so released, bends outward on drying, lifting like a hinged lid, and closing again in dampness. Examples: Mahonia, barberry, cinnamon.



833. Pistillate flower of Willow.

Showing one compound pistil; *s*, stigma; *st*, style; *o*, ovary.

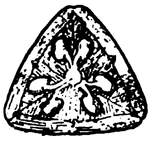
The pollen spores are, at maturity, single cells, each with a rather thick wall, which is often studded with bosses, or points, or is variously ridged. In anemophilous plants (see *Pollination*) the pollen is dry and powdery; in entomophilous plants it is usually moist and coherent. In milkweeds and orchids the whole of the pollen from each sporangium is held together in a mass by interwoven threads (Figs. 149, 513). By the time the sporangia discharge the pollen, each spore has begun a development which it completes on the stigma to which it is transferred. See *Fertilization*.

Carpels.—The carpels are the sporangial leaves which occupy the center of the flower. The number of carpels is very variable. Usually they are fewer than the floral leaves. In most flowers the carpels are united one to another to form a structure known as a *compound pistil* (Figs. 825, 833, 835, 836). When the carpels are separate, each develops as a *simple pistil*. Of these there may be one or many (Figs. 834, 837).

The pistil, if simple, first appears as a ring-like ridge about the center of the torus. If compound, knob-like rudiments of the component carpels first appear, but the growth early involves the torus between, giving rise to an elevated circular ridge. This carpellary ring gradually grows upward, partially or completely inclosing one or more chambers, in which the *ovules* arise. At a time when the ovules (which ripen into *seeds*) were supposed to be comparable to the eggs of animals, the larger chambered part of the pistil in which they are formed was called the *ovary*, a name which it still retains in descriptive botany. The pistil is often prolonged above the ovary. This part is the *style*.

834. Head of simple pistils in Hepatica.

An ovule is a fleshy sporangium, jacketed by one or two (rarely three) outgrowths from the base, the *integuments*, which almost inclose the sporangium proper (*nucellus*). Within the sporangium of the ovule, several (1 to 40) spores begin to develop. Of these, however, rarely more than one reaches maturity. This spore is never set free as the pollen spores are. It therefore acquires no thick wall, and in a section of the sporangium appears as a cavity within the delicate tissue which surrounds it. It later becomes the so-called embryo sac, within which occurs the process of fertilization (which see).



835. Section across the compound pistil of Tulip.

Showing central placenta and three-chambered ovary.

The ovules commonly arise upon certain lines or ridges which project into the pistil chamber, more rarely upon the whole interior surface of the ovary. These lines or ridges are called *placentæ*. See Figs. 825, 835, 837.

In a simple pistil there is usually but one placenta (Fig. 837). In a compound pistil the union of the carpels may be such as to produce a 1-chambered ovary, or the ovary may contain as many chambers as there are carpels (Fig. 835). In the former case the placentæ will project inward from the wall of the ovary; in the latter they will be aggregated at the center, from which they may project outward into the chambers of the ovary. When the ovules are numerous, the placentæ are often enlarged to form an adequate surface for their attachment, as in the potato and tomato (see also Fig. 837).

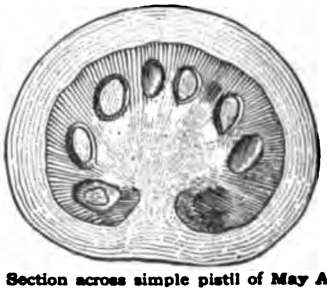
In a considerable number of plants the ovules arise upon the torus itself, a ring of which grows upward, cup-like. From the edge of this cup arise the floral and sporangial leaves, the ovules developing on its sides or base. The carpels then form a mere roof over the ovule chamber.

836. Compound pistil of catnip.

Showing 4-parted ovary, long style, 2 stigmas (*s*).

The style is sometimes slender and very long (up to several inches; see Fig. 836); sometimes short and thick (Fig. 833). Its length and form are adapted to the means by which the pollination of the pistil is secured. In some cases the style is practically wanting. Its interior is occupied by a tissue whose cells are pushed aside and partly digested by the growing pollen tube (see *Fertilization*). It is not infrequently traversed by a canal, a prolongation of the ovule chamber.

Some portion of the style, or when that is wanting a portion of the outer surface of the ovary itself, is adapted to the reception of the pollen spores. This receptive surface, whatever its form or location, is called the *stigma* (Figs. 833, 836). In many cases the upper part of the style is enlarged into a knob or club-shaped or lobed portion, the area of the receptive surface being thus increased. In other cases the style is elongated, and the receptive surface is a long line upon one or more sides of the elongated style. In other cases the style is much branched, as in the grasses, and these branches constitute the stigma. At the time the pollen is being discharged, the stigmatic surfaces are often covered by a sticky secretion. All of these devices are adaptations to insure the lodgment, adhesion and nutrition of the pollen spores (see *Pollination*).



837. Section across simple pistil of May Apple.
Showing single placenta and ovules.

The stimulus resulting from fertilization often accelerates the growth of the pistil or causes it to resume growth if it had ceased. The various changes in size, texture, color, etc., result in the production of *fruit*.

CHARLES REID BARNES.

FLOWER-DE-LUCE. The origin of the Fleur-de-lis of the French coat of arms is not known. By some it is supposed to represent the head of a spear, by others the flower of a lily. It has also been derived from the points of a crown and from several animal forms, as bees and toads. Apparently the Iris has nothing to do with the heraldic Fleur-de-lis. This name as applied to Iris is of later origin and of a purely botanical significance, referring chiefly to *I. Germanica*. See under "Fleur," Larousse, Dictionaire du XIX Siècle, 8:450.

H. Hasselbring.

FLOWER-FENCE, BARBADOES. *Poinciana pulcherrima.*

FLOWER-OF-AN-HOUR. *Hibiscus Trionum.*

FLOWERING MAPLE. See *Abutilon.*

FLY POISON. See *Zygadenus.*

FOLIAGE PLANTS. A term used to designate plants which are grown for the general effect of their foliage rather than for their flowers. The term is indefinite. In some cases, and more correctly, it is used for plants with unique or interesting leaves—usually colored—as coleus, Rex begonia, peperomia, calathea, farfugium. In other cases it is used to designate plants of full foliage and graceful habit,—plants which are prized for their general habit quite as much as for the characters of the individual leaves. Of this latter class, ferns, palms, grevillea, screw pine, araucaria are leading examples. The latter class contains the most popular commercial subjects, and they are much used in room and table decorations. The plants are often rented for use in temporary decorations. For the culture of Foliage Plants, refer to the various genera.

FONTANÈSIA (after Réné Louiche Desfontaines, prominent French botanist, 1752–1833, director of the botanical garden at Paris). *Oleàceæ.* Ornamental deciduous shrubs, with opposite, rather narrow, entire lvs. and whitish fls. in short, terminal panicles. They retain the foliage unchanged until late in fall, and are well adapted for shrubberies, growing in any good garden soil. *F. Fortunei* is nearly hardy North, *F. phillyræoides* only half-hardy. Prop. readily by greenwood cuttings under glass in early summer; also by layers, by grafting on privet, and by seeds. Two species from W. Asia and China. Glabrous shrubs, with slender, quadrangular branches: fls. perfect; calyx lobes and petals 4; stamens 2, exceeding the petals: fr. a flat, winged nutlet.

Fórtunei, Carr. (*F. Califórnica*, Hort.). Shrub, to 15 ft.: lvs. lanceolate or ovate-lanceolate, acuminate, shining, quite entire, 2–4 in. long: fls. in axillary and terminal clusters, forming a narrow, leafy panicle: fr. broad, oval or ovate, ¼–⅓ in. long. May, June. China. R.H. 1859, p. 43.—Sometimes united with the following, to which it is superior by its more vigorous growth, the darker and larger foliage, and by the greater hardiness.

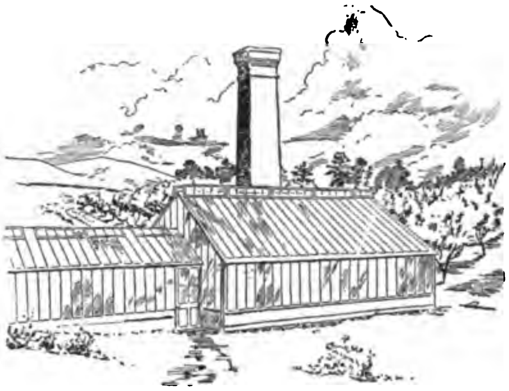
phillyræoides, Lab. Shrub, to 10 ft.: lvs. ovate-lanceolate or narrow-elliptic, mostly with rough, minutely denticulate margin, 1⅓–2⅓ in. long: fls. almost like the former. W. Asia. L.B.C. 14:1308. Var. **angustifòlia**, Rehder (*F. angustifòlia*, Dipp.). Lvs. narrow-lanceolate or oblong-lanceolate.

Alfred Rehder.

FORAGE PLANTS are treated only incidentally in this work, as they belong to agriculture rather than to horticulture. They are mostly grasses and leguminous plants, and have a very large special literature, much of which can be obtained free from the U. S. Department of Agriculture, Washington, D. C. Write to the Division of Publications.

FORBIDDEN FRUIT. See *Citrus Decumana* and G.F. 9:163.

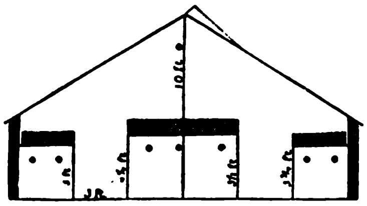
FORCING. The word Forcing is variously used. Properly, it should designate the growing of plants outside their usual or normal season. This distinguishes Forcing from the ordinary purpose of the glasshouse, which is to imitate the usual season in which plants grow. For example, begonias are not forced: we endeavor to protect them and to give them the season and the conditions under which they grow in the wild. Carnations when flowered in the winter are forced, because we transpose their seasons. Chrysanthemums blooming in October and November are not forced: they are only protected. Sometimes the word Forcing is used in a very special sense, to denote the production of flowers from bulbs or tubers in a very short time under the influence of a very high temperature. Thus, the lily-of-the-valley may be placed in a temperature of 90° or above, and the large buds be forced to throw out their flowers before the plant obtains a firm foot-hold on the soil.



838. House constructed without rafters.

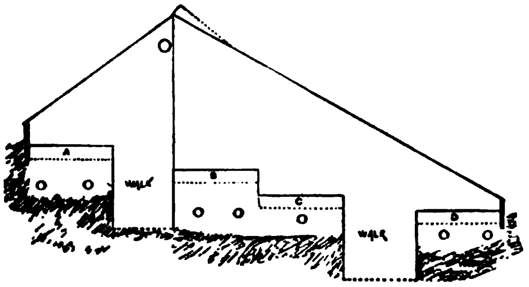
A Forcing-house is a building in which plants are forced; but the term has come to denote a simple glass-house in which plants are grown only for sale, in distinction from private conservatories, or more elaborate structures which are used for the display of plants. See *Greenhouse.*

The Forcing industry in America is very large. Heretofore it has confined itself mostly to Cut-Flowers (which see), but pot-plants, vegetables and fruits are receiving more and more attention. The staple forced flowers are the rose, carnation, violet, lily-of-the-valley, and various bulbs. These are treated under their respective names. Of vegetables, the most important Forcing species is lettuce. This is followed by tomato, cucumber and radish. Other vegetables are of very minor importance as Forcing products. The growing of fruits under glass is receiving increasing attention in this country. Very little of this fruit-raising is really Forcing, however, since the glass inclosure is used chiefly to protect the plants and to enable better care to be given: the fruit does not ripen much ahead of its normal season. Of this category are glasshouse grapes. Strawberries are really forced, however, the whole period of vegetation and bloom being greatly forwarded. Much attention is now given by florists to the Forcing of hardy plants; and this is one of the most delightful of horticultural operations for the amateur. Many of our native plants can be forced with the greatest satisfaction, but the business is usually confined to imported stock of florists' plants.



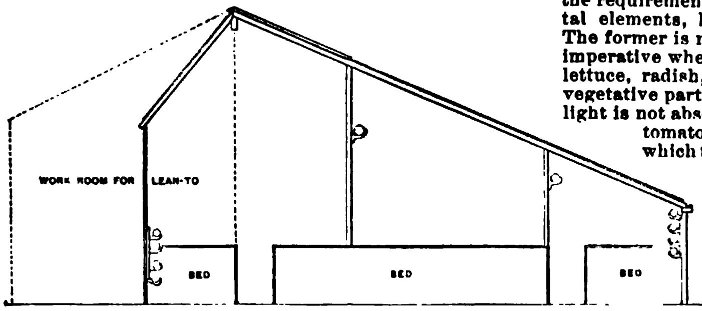
839. Even span Forcing-house, 20 ft., wide, heated by steam.

The Forcing-house should be of the simplest construction. The plan should secure the greatest amount of light, economy of space and of heating, and directness and simplicity in every operation. The simple sash-bar frame, without rafters (Fig. 838) is the most satisfactory when properly constructed. The side walls should be low and the roof comparatively flat. Usually there is no glass on the side walls. Under most conditions, the house should run north and south, particularly if even in span (Fig. 839), but the lay of the land and the location of existing features usually determine the direction. If the house runs east and west, or if it stands on sloping land (Fig. 840), an uneven or broken span is usually advisable. The widely different opinions respecting the merits and demerits of the different spans are proof that each is good under certain circumstances. It is the prevailing opinion that, in broken spans, the long roof should be to the south; yet some of the best newer houses have the short span—which is then very steep—facing the south (Fig. 843).



840. Uneven span Forcing-house, 20 ft. wide, on a side hill. Heated by steam.

In America, all Forcing-houses are heated by means of small wrought-iron pipes, which fit together with threads. The old-time cast-iron flues may be employed for conservatories, but they are too bungling for Forcing-houses. They do not admit of sufficient modification in lay-out to adapt them to the long and often crooked runs of Forcing-house establishments. The wrought-iron pipes are heated either by steam or water. Each system has its advocates, which means that each has its merits. Steam is less costly to install, since less pipe is required. It also admits of greater variation in the lay-out. Crooks and obstacles are more easily overcome. In a large establishment, the place may be heated up sooner. Hot water gives a milder heat because the pipes are less hot. Of itself, it is less liable to fluctuations. Theoretically, it is less expensive in fuel; but in practice, the cost of running is found to depend more on the character of the particular system and the operations of the fireman than on the medium itself. When properly installed, steam is as uniform in action as water, and it is adapted to larger areas and to higher temperatures.



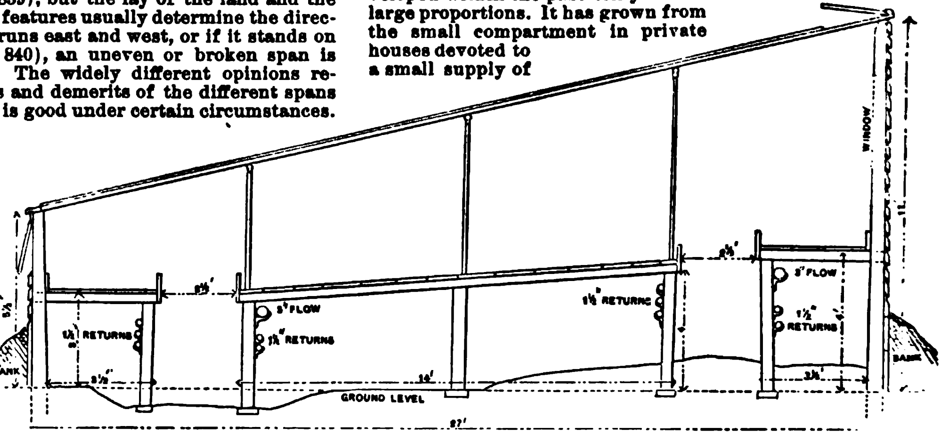
841. Uneven span Forcing-house, 30 ft. wide. Hot water.

The ideal shape for a Forcing-house is probably in the proportion of breadth to length as 1 is to 4 or 5. The best houses are rarely less than 18 or 20 ft. wide, and rarely more than 30 to 35 ft. From 400 to 500 ft. is considered to be the greatest profitable length. Houses of greater length are now building, but they must be considered an experiment. Parallel houses are often "nested" with good results,—the adjoining houses resting on a common wall. When the various houses are to be used for one kind of crop, the partitions between them may be omitted: a very large space may then be covered with practically one house without the necessity of rearing a high roof.

The accompanying illustrations (Figs. 838–843) show various current styles of American Forcing-houses. For further discussion of glass houses, see *Greenhouse*.

L. H. B.

The Winter Forcing of Vegetables.—The growing of vegetables under glass for the winter market has developed within the past ten years to large proportions. It has grown from the small compartment in private houses devoted to a small supply of lettuce and radishes to entire ranges of modern houses, in which are grown almost the entire list of tender vegetables. The special crops, however, are usually confined to four, the management of which is here discussed,—lettuce, radishes, tomatoes and cucumbers.



842. Lean-to lettuce house, 26 ft. wide. Hot water.

The Forcing of any winter crop is a matter of principles rather than practice, since local conditions have everything to do with the methods of culture and the kinds of vegetables forced. It frequently happens that the same vegetable is grown with equal success in soils of widely different character by different cultivators. Skill in management and close attention to details are the requirements necessary to success. Two fundamental elements, however, are essential: heat and light. The former is needed by all crops; the latter is almost imperative when fruit is wanted. With such crops as lettuce, radish, rhubarb and asparagus, in which the vegetative part only of the plant is wanted, bright sunlight is not absolutely necessary; but with such crops as tomatoes, cucumbers, melons and beans, in which the fruit is the aim, no amount of heat will prove a substitute for sunlight in ripening the pollen, which is often the critical factor in the results. Therefore, a situation where the maximum of sunshine may be had should be selected if such crops are to be grown.

The construction of the house is not a matter of the first importance. The three-quarter span house perhaps furnishes as nearly as possible the best condition for forced crops. However, an even-span or shed-roof house grows many crops to a high degree of perfection. As to the inside arrangement of the house, the crops to be grown will have much to do in the matter. Cool-house crops, as lettuce, radish, and the like, are well grown in solid beds; while heat-loving plants, as tomatoes, cucumbers, melons, etc., should be planted on benches built over the pipes. This means that the cost of building a greenhouse depends very much on what crop one expects to grow. The saving in benches and heat in houses devoted to cold crops is considerable, while the ease with which such crops may be grown recommends them to the beginner.

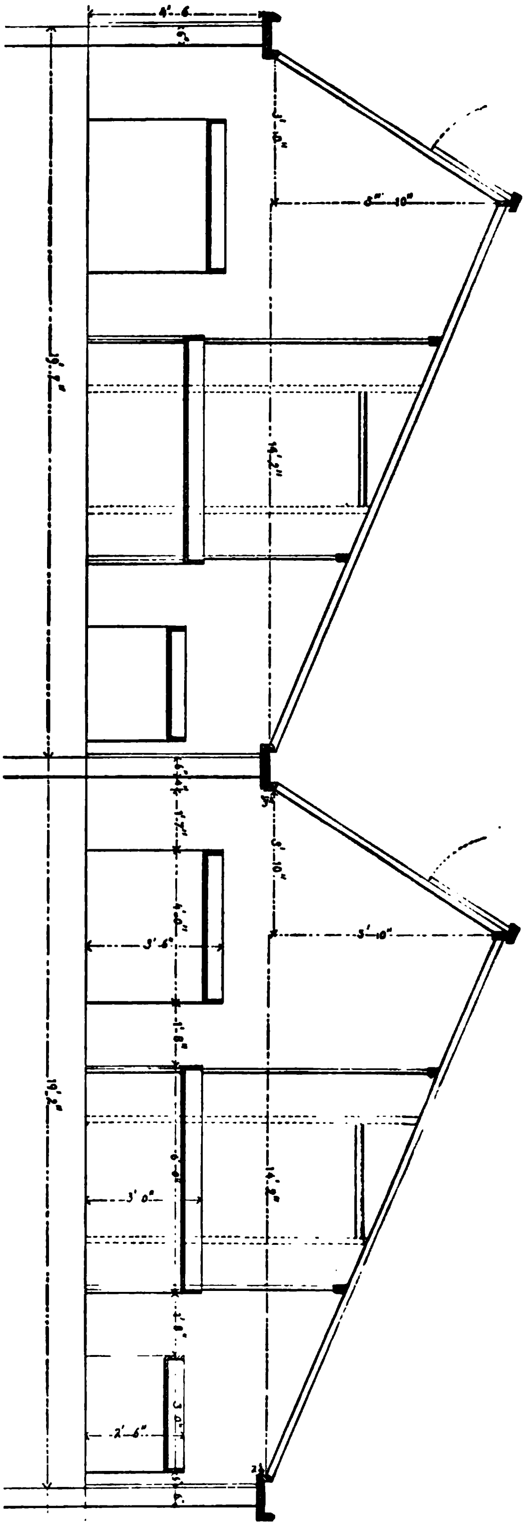
The best paying crops are probably cucumbers and tomatoes; the most exacting, melons. The demand for melons, however, is limited, and the cost of producing good flavored, well ripened fruits in winter is high. Having stated what we conceive to be underlying principles in the winter Forcing of all vegetables, we may consider each of the important crops separately.

Lettuce.—The ideal soil for lettuce would be a well drained gravelly or sandy loam, but with care in watering a soil of heavy texture may be made to produce excellent crops of the loose, open varieties. The heading or cabbage lettuce is more exacting if a fine quality is desired. The first crop of lettuce from the houses should be ready to use by the middle of November. For this crop seed should be sown in September, allowing on an average from 6 to 8 weeks for the crop to mature. A temperature of 55°-60° through the day, with a drop to 40° or 45° at night, will suit all varieties, but in the case of the heading varieties a rise of 5 to 10° at the time of heading will finish off the crop more uniformly.

Radishes require the same general treatment as lettuce and may be grown in the same house. As radishes mature in about half the time lettuce does, the radish seed may be sown between the rows of young lettuce plants, and the product is out of the way when the lettuce begins to need the entire space.

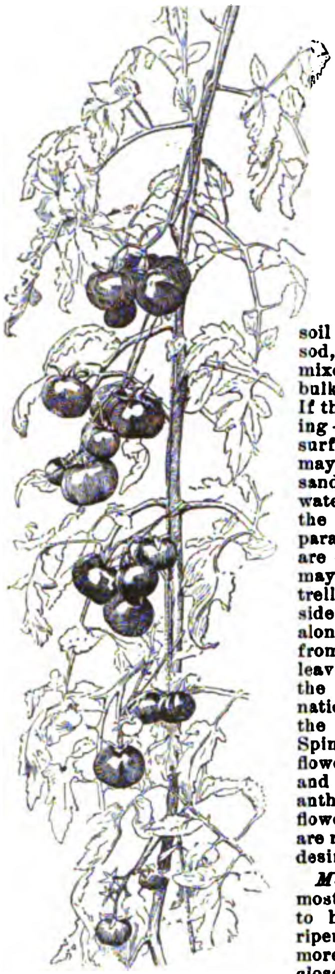
Tomatoes being a hothouse crop, require a temperature of 75° by day, with a drop of about 5°-10° at night. This is one of the crops which is dependent on the sun, because the pollen must be dry and light in order to pollinate the pistils and produce fruits. The soil for tomatoes may be on the heavy order, and contain a large proportion of fibrous loam, with well rotted manure. As to chemical fertilizers, the best results are to be obtained not from those rich in nitrogen, but from potash and phosphoric acid, as these elements are largely responsible for a slower growth of plant and fruit and a firmer texture and higher flavor of marketable product. To obtain a good yield of fruit through the winter months, it will be necessary to pollinate each flower. This may be done very rapidly. The pollen is jarred into a spoon-like receptacle, and the end of the pistil is touched with the accumulated pollen. As spring approaches and the sun becomes stronger, a simple jarring of the plants is all that is needed. As to training, the single-stem method has been found to be the best, as the plants can be set much closer and still allow plenty of room to work around each one. This method consists in the pinching out of all lateral growths. Train the stem to a cord, and support the heaviest clusters by strings (Fig. 844). Plants from seeds sown in August will ripen fruits about the first of January, and should continue in bearing until May. A succession may be had by growing fresh lots in pots or boxes to take the place of exhausted plants. The season of forced tomatoes may be thus continued until the outdoor product fills the market.

Cucumbers are much forced in the eastern states. Cucumbers are a very exacting crop, and need special care in growing. The White Spine type is perhaps more generally grown in this country than the long Forcing cucumber of the Old World, which has been grown and selected for its Forcing qualities for many years. One of the reasons why the former is the more generally grown is its adaptability to relatively unfavorable conditions. It grows in the full sunlight, is more able to resist attacks of mildew and red spider, and sets its fruit with more freedom than the Old World types. One other reason may be that the people of this country



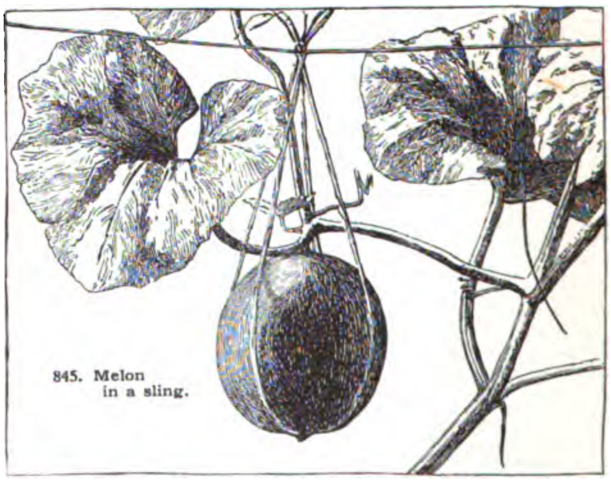
843. Short-span-to-the-south Forcing-houses. A type of house which has come into vogue in recent years.

have not become accustomed to the long, thin fruit of the English varieties. The English or forcing varieties require partial shade through their season of growth. Seeds sown singly in 3-inch pots in August will, if they have no check, bloom and set fruits in December. The fruits of the White Spine type reach edible maturity 2 and often 3 weeks before the English type. The houses in which cucumbers are grown must be arranged with heat below the benches, as it is of the greatest importance that the plants make a rapid growth and receive no check due to the cooling of the soil. The soil should be a good pasture sod, partially rotted, and mixed with one-fourth the bulk of leaf-mold and sand. If there is danger from damping-off of the vines at the surface of the soil, the plants may be set in a handful of sand, which will allow the water to soak away, leaving the stem of the plant comparatively dry. If the vines are on a central bench, they may be trained to a vertical trellis made of wire, or, if on side benches, to wires run along the roof far enough from the glass to hold the leaves away from frosts. As the flowers open, hand pollination will be resorted to if the crop be of the White Spine type. Pick a staminate flower, strip back the corolla, and insert the column of the anthers into the pistillate flower. The English varieties are not pollinated, unless it is desired to secure seeds.



844. Strand of winter Tomatoes.

Melons are certainly the most difficult of winter crops to handle. The midwinter ripening of the fruits requires more painstaking care and closer attention than any other crop. The plants, from seed-leaf to fruit, must be grown in heat without the slightest check. They should be planted on the bench in a strong, loamy soil, which is retentive enough to hold moisture at the roots but not heavy enough to become sour. No shading of the glass is required, but air should be given freely on all days when possible. The plants are trained as are cucumbers, except that the central shoot should be pinched out as soon as the plants are well established in the bench, allowing 3 or 4 lateral branches to grow to the height of 4 or 5 feet, when these in turn should be pinched back. In setting the fruits, it is best to wait until a number of pistillate blossoms are open on a plant and pollinate them at the same time, as it often happens that if one fruit starts into growth some time before other flowers are pollinated, the other fruits fail to set until the first one reaches considerable size. Pollination is accomplished in the same manner as with cucumbers, and should be done on sunny days, when the houses are dry. Except during the time of setting the fruits, the house should be moist and the leaves sprayed frequently. The temperature of the melon house should run at least 5° higher than for cucumbers. Hang the fruits in slings (Fig. 845). Melons ripening in fall or spring are more easily managed.



845. Melon in a sling.

Beans may be easily forced in houses where cucumbers or melons are growing, using rich, moist soil and strong bottom heat. They are usually grown in pots, 3 or 4 plants in a 6-inch pot. They make a very rapid growth, and the green pods are fit to use in from 8 to 10 weeks from the time the seed is sown. While growing the plants should be sprayed with water frequently, as they are very subject to attacks of red spider. The bean is self-fertile, and need not be pollinated (Fig. 846)

Asparagus and *Rhubarb* are forced from old roots brought in from the garden, and subjected to a gentle heat. The crop is made from the material stored up in the old roots, few new roots growing through the forcing period. The old roots are thrown away after being forced, and others brought in for the next crop. Both these crops may be grown in out-of-the-way places,—under the benches, in corners of the potting shed, or in fact anywhere where heat and moisture may be had. One method of forcing rhubarb is to grow it entirely in the dark. This produces a very tender stalk with very little foliage. C. E. HUNN.

FORCING OF FRUITS.—The house best adapted for fruit-growing is one running north and south, span roof curvilinear, with ventilation both sides, top and bottom. It is important to be able to give a large quantity of air, especially for ripening the wood after the growth is done. The next thing to be considered is the borders. To produce high-class fruit, perfect drainage is necessary. For very early forcing an inside border will answer the purpose, but the most satisfactory way is to have both outside and inside borders. A depth of 3 ft. of prepared soil is sufficient, with 9 in. of drainage material on the bottom. Should there be a natural outlet for the drainage water, well and good, otherwise artificial means must be resorted to. The width of the outside border should be 15 ft. An outside border is particularly advantageous for vines and peach trees, which will last much longer in a healthy, vigorous condition if allowed a root-run outside the greenhouses. A sod cut from the pasture, suitable for growing roses, would be ideal for the borders. The writer does not recommend making a border very rich, for too often young vines are poisoned with food at the start. A sprinkling of coarse crushed bone and charcoal should be mixed with the soil. In the use of charcoal one should be governed by the nature of the soil; if the soil is extra heavy, use charcoal more freely. A top-dressing of cow-manure mixed with soil is a good thing when starting a house. A medium loam, neither stiff nor too heavy, answers the purpose.

The trees also may be grown in pots and tubs. One advantage is that a special fruit house is not necessary. Many a house is going idle during the summer months that would grow fruit to perfection. Any light house with plenty of air will grow fruit satisfactorily. One of the main points is in the watering. Should the trees get too dry, or on the other hand saturated, the chances are that the fruit will turn yellow and drop, but with good judgment and a certain amount of care success is assured. The trees should be repotted every fall, as they need so much water during the summer months that the soil becomes depleted. However, one should be careful not to overpot. A compost suitable for potted trees is a fairly heavy loam, and say three parts of soil to one of well rotted manure, with a little wood ashes and bone meal worked in. Potted trees are interesting, as there can be a considerable variety of fruit grown in this way. Figs. 847 and 848 illustrate the method of pruning.

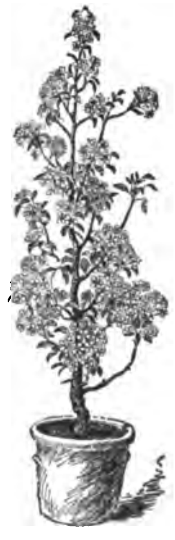
846. Bench of winter Beans.

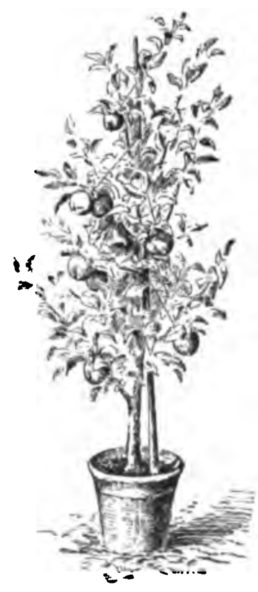
Grapes.—In planting grape vines, 2-year-old canes should be set. Plant the canes 3 or 3½ ft. apart. There is nothing gained by crowding, and in planting young vines, cut them down to about 18 in., to insure good, established vines from the bottom. There can be no hard and fast lines laid down as to how long the vines will bear profitably. With good treatment they should be profitable for 15 or 20 years. A grapery should be started with a night temperature of 45–50° F. and a rise of 10° or 15° with sun heat in the day. The temperature should be raised 5° every two weeks, until a night temperature of 65° is reached. After the grapes are set, a night temperature of 70° will be the right thing. The vines should be syringed three times a day until they are started into growth; then twice a day until the foliage gets heavy, and thereafter once every bright day is all that is necessary, mornings preferred. After the grapes commence to color, syringing should be stopped. Foliage is another thing to be considered. With our hot sun a fairly good covering is necessary. The shoots should be stopped at the second or third leaf beyond the bunch, and all laterals pinched at the first leaf. The aim should be to have a nice covering of foliage over the house, but avoid severe crowding. Grape thinning requires good judgment. Always make it a practice, if possible, to thin the bunches all that is necessary the first time, as going over the bunches the second time is not so satisfactory. A bunch must be so thinned that each berry has room to develop without crushing. Water also plays a prominent part in finishing a crop of grapes. While grape vines are moisture-loving plants, it is poor policy to give them a heavy watering after the grapes begin to color. If the plants receive a heavy watering when the grapes start their second swelling, it should be enough until the grapes ripen. After the crop is off the treatment is simple: keep full air on top and bottom; syringe the foliage if red spider makes its appearance, and water the border when dry. Vines that are not intended to be started until February or March should be pruned when the wood is thoroughly ripe. The canes should be brought down and wrapped in burlap to keep the sun off them, and then a matter of 5° or 6° of frost in the house will do no harm. In severe weather it pays to turn a chink of heat in the house. As on all other fruits, there are many varieties, but only a limited number of standard sorts. For an early grape there is no better than the old standard Black Hamburg, which is easy to handle and a very satisfactory variety. A companion to it is Buckland Sweetwater, a white grape ripening at the same time, though of second-rate quality. Its earliness, however, makes it worthy of a place.

Muscat of Alexandria should have a house to itself. To finish this noble grape to perfection requires more heat than ordinary. It can be grown with fair results in a mixed house, but where there are three compartments for early, midseason and late varieties, the midseason compartment should be planted to Muscats. Madresfield Court is also a grape of fine quality. Unfortunately it is difficult to handle, although it is usually planted in a house with such easily handled varieties as Gros Maroc, Gros Colmar, Barbarossa, Mrs. Prince, Alicante. For another view, see *Grape.*

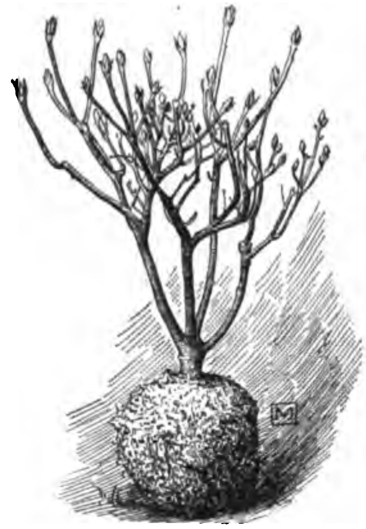
Peaches and Nectarines.—The same depth of border recommended for the grape vines will be all right for the peach. These, also, must have perfect drainage or the trees will soon get into a sickly condition. The peach and nectarine have a tendency to rank growth when planted in the border. Care should be taken not to make the border too rich. It is an easy matter to apply food when the trees need it. The writer has found a light application of wood ashes two or three times in the season a capital thing. Crushed bone is also beneficial. When starting the house, a top-dressing of soil and cow-manure, say two of soil to one of manure, should keep the trees in a healthy condition. One important point in starting a peach house, especially early in the season, say the first of January or earlier, is to start easy. Nothing is gained by rushing. There are numerous varieties of peaches and nectarines adapted to Forcing. The following is a selection of the best that the writer has grown under glass: Peaches, *Early*—Hale Early, Alexander, Condor, Mountain Rose, Haine's Early; *Midseason*—Foster, Bellegarde, Noblesse, Oldmixon Free; *Late*—Crawford's Late, Sea Eagle, Princess of Wales, Lady Palmerston.

Nectarines, *Early*—Cardinal, Early Rivers, Advance, Lord Napier; *Midseason*—Improved Downton, Dryden, Byron, Elruge, Milton; *Late*—Chaucer, Newton, Spencer, Stanwick, Humboldt, Victoria. Trees for planting in the house should be especially prepared for the work. A year would be lost with such trees as are usu-


847. Pot-grown Pear Tree in bloom.

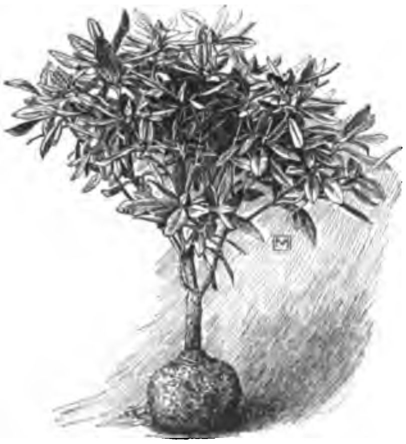

848. Pot-grown Apple Tree in bearing.

ally offered for sale. For planting in the border, choose fan-trained trees, 2 or 3 years old, providing they have been properly transplanted. (See *Pruning.*)



849. Azalea, received from Europe, now pruned for forcing.

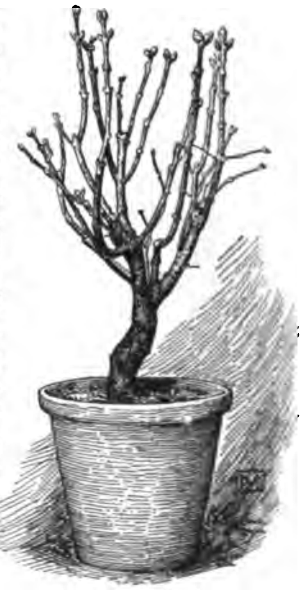
Indoor peaches and nectarines, with proper care, are profitable for 10 years after planting. The following temperatures for the peach house are suitable for early Forcing: for the first two weeks, 40° by night and 50° by day; then a rise to 45° by night and 55° or 60° by day, with the sun, which should carry them until their blooming period; then 50° by night and 60° to 70° by day, with sun heat; after the fruit is set, a rise of 5° or 10° on mild nights would be all right, with the day temperature correspondingly increased. Peaches delight in fresh air; therefore air should be given at every opportunity. Syringe the trees twice a day in bright weather; hold off while the trees are in blossom; after the fruit is set, syringe again twice every bright day, and once a week with whale-oil soap, using enough soap to just color the water. This is a good remedy for greenfly, spider, etc., and produces a fine, glossy foliage. It is better to disbud by degrees rather than to remove a large quantity of foliage at once, which would naturally cause a check to the tree. Disbudding requires good judgment. The shoot, if not needed, should be pinched, leaving three or four leaves to develop the fruit. Trees that are properly cared for during the summer months need little pruning in the winter. Probably the hardest task of all to the grower is thinning the fruit, but this must be done. There cannot be any set number for a tree to carry. Judgment must be used in that respect. Nectarines can be cropped more heavily than peaches. After the crop is gathered, all the useless wood should be cut away to allow plenty of light and sunshine around the wood that is intended for the following season. When the wood is thoroughly ripened it is in condition to stand zero weather. The temperature of peach houses can go down below zero without a bud being killed. In fact, it is not necessary to use any artificial heat until starting the house. Close the house down frosty nights; open up in the morning before the temperature rises much, and avoid exciting the buds. Sometimes one has warm days during the winter months. On such days it is well to keep doors as well as ventilators open.



850. Rhododendron, received from Europe, ready for forcing.

All the peaches and nectarines recommended for the peach house are admirably adapted for pot work.

Other fruits may be added to these, as apples, pears, plums, cherries, figs, apricots, etc. (see articles under these headings). The following are some of the best varieties the writer has grown: *Plums*—Golden Esperin, Jefferson, Denniston Superb, Green Gage, Grand Duke, The Czar, Early Transparent; *Pears*—Magnet, Princess, Souv. du Congres, Louise Bonne de Jersey, Pitmaston Duchess, Beurre Diel; *Apples*—Williams Favorite, Benoni, King of the Pippins, Washington, King of Tompkins County, Belle de Pontoise, Bismarck, Peasgood Nonesuch, Lady Henniker, Thomas Rivers, Alexander, Cox Pomona. Wm. Turner.



851. Lilac pruned for forcing.

Forcing Hardy Plants.—An economical method of obtaining large quantities of flowers in winter: extensively used by commercial florists for cut-flowers and flowering plants. Plants usually forced are hyacinths, tulips, narcissus and other Dutch bulbs, lily-of-the-valley, astilbe, dicentra, hybrid perpetual roses, *Deutzia gracilis*, hybrid rhododendrons (*R. Sinensis*, i.e., *Azalea mollis*), and Ghent azaleas, and lilacs. For other plants, see A.G. 14:402 (1893).

This mode of procuring flowers at small cost has always been more or less in vogue among plantsmen, and of late years has received fresh impetus, owing to the heavy demands for decorative plants at Easter. It is not only an inexpensive method of getting flowers, but with most plants, after a little experience, the time of blooming can be easily calculated. The process has limitations, at any rate with our present knowledge of the matter, inasmuch as, with the exception of "retarded plants" and a few bulbs, it is not practicable in late autumn and early winter. It is possible, however, that by using "retarded plants," i.e., plants held over their natural time of flowering by keeping them in cold storage at a temperature sufficiently low to prevent growth, this difficulty may eventually be overcome. Except, however, with lily-of-the-valley, which is admirably adapted to this practice, we know little of the possibilities of this form of Forcing: it is hoped that other plants, equally useful, may be treated in this way. It is evident that, on account of the cost of storage, bulky plants could not be handled.

The requirements for successful Forcing are: (1) a good knowledge of the plants; (2) proper preparation; (3) a period of rest; and (4) proper care after the plants are brought into heat.

Those plants force most easily which bloom in spring and early summer. Late-blooming kinds, like *Rhododendron maximum*, Clethra and *Hydrangea paniculata*, var. *grandiflora*, do not give good results. No success is obtained with asters and goldenrod, unless they are retarded. These points must be studied out by the grower.

Trees and shrubs should be specially prepared for Forcing by careful cultivation for 1 or 2 years before use. They can be planted out of doors, with plenty of room to develop, or they can be grown in pots; the latter method being used with vigorous plants, which are apt to run to growth without developing flower buds Close pruning is necessary, and root-pruning is helpful Grafting, which has a tendency to dwarf and hasten maturity, is also used with strong growers. Sometimes both growing in pots and grafting are employed, as in lilacs. Query: Could we learn anything in these particulars from the Japanese method of dwarfing plants?

A plant fit for Forcing must be compact, both top and roots; economy in space is essential. It is now possible to obtain from the French, Dutch and Belgian nurseries many plants grown for this purpose. A few come pot-grown, but most of them are from the open ground: very little of this work is done in American nurseries. Figs. 849–851 show the methods of preparing woody plants for Forcing.

852. Dicentra roots prepared for forcing.

Herbaceous plants should be prepared for Forcing with equal care, and the process may require several years. The removal of the flower buds and growth, under high cultivation, in close, compact clumps, apparently produces the same results that pruning and grafting accomplish for trees and shrubs. Fig. 852 shows the root-clump of an herb prepared for Forcing.

Plants that have once been forced are commonly thrown away. It is generally cheaper to buy new stock, but lilacs, azaleas, etc., can be planted out and will recover sufficient strength in 2 years for a second Forcing, or for other use. Some species, like *Viburnum plicatum*, staphylea, colchicum, etc, if grown on in pots after Forcing, may be again forced, and seem to do better the second year. This is probably explained by the fact that insufficient preparation was given for the first trial, the first Forcing being really "proper preparation" for the second Forcing.

Hardy plants must have a period of rest for successful Forcing, the time required varying in different species. One cannot tell, except by experiment, that Paper White narcissus will force easily in November and December, while the double Von Sion will not; the individual equation of each kind is an element which must be considered. There is a popular notion that freezing will shorten the time for resting, or, at any rate, is conducive to the welfare of the plant. This idea does not seem to stand any practical test. After potting, do not subject the plants to severe frosts (10 or 12° F.), or else the roots, now much exposed, may suffer. The large buds of lilac and rhododendron may also be injured if frozen hard.

Pot the plants as soon as they ripen their growth in autumn, beginning in September with herbaceous stock, and continuing until severe frost. It is possible, but not desirable, to lift some things after the ground is frozen hard. Plants received from abroad are potted on arrival, or, if furnished with a ball like azaleas (Fig. 849), they can be stored and not potted until brought into heat. Dutch bulbs are boxed or potted as they are received, and buried in the earth or piled in stacks and covered with enough leaves and litter to exclude frosts. Lily-of-the-valley, astilbe and dicentra are kept in their packing cases in a cool pit until ready for use. Large plants in tubs and boxes can be covered with leaves and kept out of doors, but most plants should be stored in a cool cellar, pit or frame kept at a temperature of 35° F.; a temporary variation of 5° either way does no harm. It is well to delay this storage until as late in the season as possible, but it must be done before severe weather. They can be stowed compactly, in several tiers if necessary. It must be remembered that no growth is to be allowed while stored; it is their period of rest, and this must be enforced. Good ventilation must be given on bright days and every precaution taken against an accumulation of moisture: if the plants are well watered when put away very little will be required afterwards. Dampness is most serious with evergreens, like kalmia, and such things as *Phlox subulata*. This stock should have the airiest positions, or it can be placed in shallow frames 2 ft. deep, which are drier than deep pits. In severe weather the pits are often covered with snow a week or more, but the plants will not suffer if this happens but once or twice during the winter. At such times mice and squirrels will make trouble unless trapped or poisoned.

853. Forcing Lily-of-Valley in pots.

Nothing except retarded plants, a few bulbs and one or two kinds of prunus should be brought in before November. December 15 to January 1 is as early as it is safe to begin Forcing most hardy plants; it will be found that as the days lengthen the results will be more satisfactory. At first the plants must be kept cool, 45° F. or thereabout. Syringe twice a day until the buds swell: after growth starts the treatment is the same as that given greenhouse plants, and they can be put in a much warmer house if so desired. It is at this time that care in handling, particularly in the matter of heat, makes it possible to time the period of blooming so accurately, but it is impossible to give any general rules to satisfactorily cover these matters.

854. Forced Trillium.

A few plants, like lily-of-the-valley, can be placed directly in a Forcing-box or pots, generally made over the pipes in the hottest house, where a temperature of 80° to 95° F. can be maintained. They are first soaked in water for a day or two and then kept in this heavy heat until flower buds are well developed (Fig. 853). Tulips, hyacinths and other bulbs, sometimes an azalea or lilac, can also be hurried up in such a box, but it is dangerous, and not good practice; better and more lasting flowers come with ordinary treatment. Trilliums (Fig. 854) and various early-flowering wild plants may be forced with satisfaction.

Although no rules can be given for the time required in Forcing, it is knowledge not hard to acquire with even surprising exactness. Nothing is likely to require more than three months in houses ranging from 45° to 55° F.—i. e., after bringing in from the pits. A month or six weeks is good time to allow in February and March, but with the same plants and temperatures, more time would be needed earlier; with the advance of the season, the work is quicker and less uncertain. There is great difference in plants. Rhododendrons (the hybrids) require eight weeks or more, but one species will often bloom in March, within twenty-four hours. Plants like the rose, which must make a growth before the buds form, take more time than azaleas. The difference between dull and bright weather is an important factor, but with extra firing, or the use of the Forcing-box, these matters even up, and the average time of flowering is wonderfully even. In this work, a man with good plant sense is most likely to succeed.

B. M. Watson.

855. Forsythia suspensa, var. Sieboldi (× ½).

FORESTIÈRA (after Forestier, a French physician). Syn. *Adèlia*. *Oleàceæ*. Deciduous, rarely evergreen trees or shrubs, with opposite, entire or serrate, generally rather small lvs., inconspicuous yellowish fls. and small black or bluish berries; without much decorative value, and but rarely cultivated. They cannot be grown North, except *F. acuminata* and *F. ligustrina*, which are tolerably hardy in New England. They grow in almost any soil, and are propagated by seeds and layers. About 15 species in N. Amer., from Illinois south; also in Mex. and W. Indies. Fls. diœcious, apetalous, with or without calyx, in small, axillary clusters in early spring, before the lvs.; stamens 2–4: fr. a small, mostly black, 1- or 2-seeded berry.

acuminàta, Poir. (*Adèlia acuminàta*, Michx.). Deciduous shrub, to 10 ft. high, sometimes spiny, glabrous: lvs. slender petioled, ovate-oblong or ovate-lanceolate, remotely serrate, 1½–4 in. long: staminate fls. in dense clusters; pistillate fls. in short panicles: fr. narrow, oblong or cylindrical, falcate, acute, ½ in. long. W. Illinois to Texas. Michx. Fl. Bor. Amer. 2:225. B.B. 2:603.

ligustrina, Poir. (*Adèlia ligustrina*, Michx.). Deciduous shrub, to 6 ft., pubescent: lvs. elliptic-obovate to oblong, obtuse, appressed-serrulate, about 1 in. long: fls. in fascicles: fr. sessile, short-ovoid, obtuse, ¼ in. long. Tenn. to Fla. and Ala.

F. Nèo-Mexicàna, Gray. Shrub, to 10 ft.: lvs. spathulate, almost entire, usually glabrous, grayish green and rather small: fr. ovate or short-oblong, obtuse, ⅓ in. Texas to N. Mex. and Colorado.

Alfred Rehder.

FORESTRY is the rational treatment of forests; this treatment may vary with the object in view. Forests may subserve various objects, giving rise to three classes of forests: they furnish wood materials for the arts—*supply forests*; they furnish a soil cover, which prevents the blowing of the soil and formation of sand dunes, or which retards the erosion and washing of the soil and regulates the waterflow, or which acts as a barrier to cold or hot winds, and exercises other beneficial influences on climate and surroundings—*protection forests*; or finally, they furnish enjoyment to the

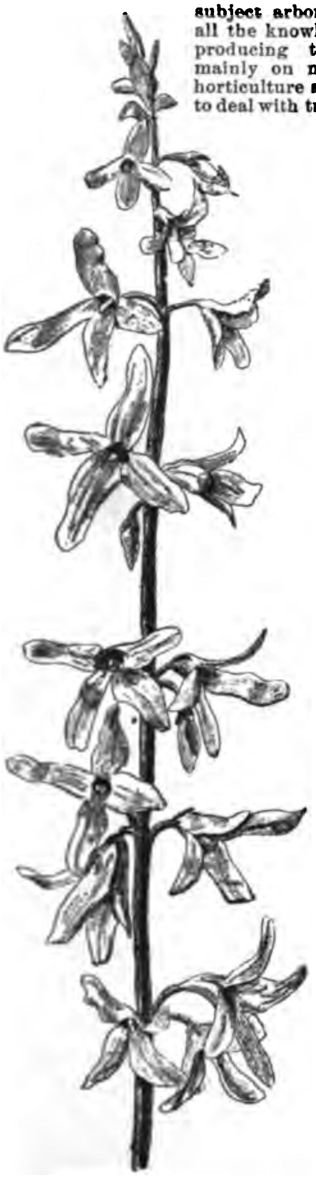
856. Flowers of Forsythia suspensa, var. Fortunei. Natural size.

esthetic and sporting elements in man, as game preserves and parks—*luxury forests*. Any two or all three objects may be attained simultaneously in the same forest. In the end, and in a more limited sense, Forestry is the art and business of making money from the growing of wood crops, just as agriculture and horticulture are finally concerned in producing values from food crops. In the economy of agriculture, wood crops may be grown on land which is too poor for field crops.

This art is divided into two distinct and more or less independent branches, namely silviculture, the technical branch, and forest regulation, the business branch. Silviculture is a branch of the larger subject arboriculture, and comprises all the knowledge and skill applied in producing the wood crop, relying mainly on natural sciences. While horticulture and silviculture have both to deal with trees, their object and with it their treatment of trees are totally different: the orchardist works for the fruit of the tree, the landscape gardener for the pleasing form; in both cases the object is attained by the existence of the tree and its single individual development; the forester is after the substance of the tree, the wood; his object is finally only attained by the removal of the tree itself. He deals with masses of trees rather than individuals: it is logs in quantity and of desirable quality, clear of knots, not trees, that he is working for; hence, his treatment differs from that of the horticulturist. Since his crop takes many years to mature, sometimes a century and more, in order to carry on a continuous Forestry business, from which to secure annual returns, special arrangements peculiar to this business must be made: these arrangements, naturally influenced by the economic conditions of the country, form the subject of forest regulation.

The horticulturist, as such, is mainly interested in the rational treatment of such forests as have a protective value, influencing climatic, soil and water conditions in general and locally.

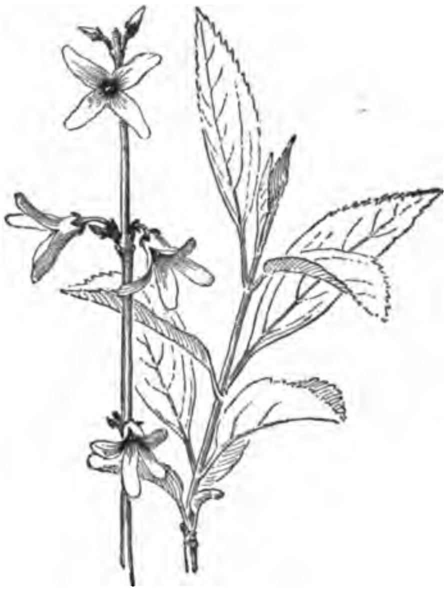
B. E. FERNOW.



857. Flowers of Forsythia viridissima. Nat. size.

FORGET - ME - NOT. *Myosotis*.

FORSŸTHIA **(after William Forsyth, prominent English horticulturist, director of the royal garden at Kensington, 1737–1804). *Oleàceæ*. GOLDEN BELL. Highly ornamental, free-flowering shrubs, with òpposite, simple or ternate lvs. and showy yellow fls., borne in great profusion along the slender branches in early spring. One of the showiest early-flowering shrubs, with handsome, clean foliage, remarkably free from insects or fungi, and remaining unchanged until late in fall. The upright forms are well adapted for the borders of shrubberies and the pendulous form for covering walls, fences, arbors or porches. They grow in almost any kind of garden soil, and are hardy North. Prop. readily by greenwood and hardwood cuttings; also by seeds. The branches of the pendulous form often take root at the tips when touching the ground, and send forth vigorous shoots, like some brambles or the walking-fern. Two species in China, much cult. in Japan, and one recently discovered in southeastern Europe. Low shrubs, glabrous throughout, with slender, quadrangular branches and opposite, serrate lvs.: fls. 1–3, axillary, pedicelled; calyx and corolla deeply 4-lobed, lobes of the corolla oblong, longer than the campanulate tube; stamens 2, included: fr. a 2-celled, dehiscent capsule, with many winged seeds.**



858. Forsythia viridissima (× ⅓).

suspénsa, **Vahl. Shrub, to 8 ft., but the branches often lopping on the ground and taking root: lvs. broad-ovate or oblong-ovate, serrate, 3–4 in. long: fls. 1–3, about 1 in. long, golden yellow, tube striped orange-yellow within; calyx about as long as tube: capsule ovate, about 1 in. long. China. S.Z. 3.—Two varieties can be distinguished. Var. Sièboldi, Zabel (*F. Sieboldi*, Dipp.). Fig. 855. Low shrub, with very slender, pendulous or trailing branches: lvs. mostly simple, broad-ovate or ovate. B.M. 4995. F.S. 12:1253. Gn. 33, p. 563. A.G. 13:94. G.F. 4:79. Var. Fórtunei, Rehder (*F. Fórtunei*, Lindl.). Fig. 856. Of more vigorous growth, with upright or arching branches: lvs. often ternate, ovate or oblong-ovate: corolla with more narrow and twisted segments. R.H. 1861:291. *F. suspensa* is an excellent shrub for the margins of groups, because it finally rolls over and meets the greensward. It can also be trained over an arbor. Less common than *F. viridissima*, but better.**

intermèdia, **Zabel (*F. suspénsa* × *viridissima*). Shrub, with slender, erect or arching branches: lvs. ovate-lanceolate, sometimes 3-lobed or ternate, coarsely serrate, 3–4 in. long: fls. almost like those of *F. suspensa Fortunei*. Gt. 1885:1182 and 40: p. 397.—Often confounded with forms of *F. suspensa*. In foliage it resembles much the following, which has the lvs. narrower, always simple, usually serrate only above the middle, with smaller teeth. It is as hardy as *F. suspensa* and very floriferous.**

viridissima, **Lindl. Figs. 857, 858. Shrub, to 10 ft., with green, erect branches: lvs. oblong-lanceolate or**

lanceolate, always simple and generally serrate only above the middle, very dark green, 3–6 in. long: fls. about 1 in. long; corolla with rather narrow, twisted lobes of bright, somewhat greenish yellow; calyx about half as long as tube. B.M. 4587. F.S. 3:261. B.R. 33:39. —Less hardy and graceful than the othe species.

F. Europæa, Deg. & Bald., from Albania, has small, ovate-lanceolate, quite entire lvs. Alfred Rehder.

FOTHERGÍLLA (after John Fothergill, eminent English physician, who introduced and cultivated many new plants, 1712–1780). *Hamamelidàceæ.* Hardy ornamental shrubs, with alternate, deciduous, simple, dull green lvs. and showy spikes of white fls. in spring with the lvs.: the distinct foliage resembles somewhat that of the alder, or more that of Hamamelis, and turns yellow late in fall. They grow best in moist, peaty or sandy soil. Prop. by seeds, not germinating until the second year, or by layers, which take two years to root; the first species also by suckers and root-cuttings. Two closely allied species in the S. Alleghanies: low shrubs, with the branches densely stellate-pubescent: lvs. stipulate, dentate-crenate: fls. in terminal spikes, perfect, apetalous; calyx campanulate, 5–7-lobed; stamens numerous, with the filaments thickened toward the end: capsule dehiscent, 2-celled and 2-seeded.

859. Fragaria Chiloensis.

Gárdeni, Murr. (*F. alnifòlia*, Linn. f. *F. Carolìna*, Britt.). Low shrub, with generally spreading branches, to 3 ft.: lvs. oblong or obovate, rounded or cuneate at the base, coarsely dentate above the middle, pubescent and pale or glaucous beneath, 1–2 in. long: spikes ovate or oblong, 1–2 in. long, leafless at the base; stamens ⅓–¼ in. long, sometimes pinkish. B.M. 1341. G.F. 8:445. L.B C. 16:1507.

màjor, Lodd. (*F. monticola*, Ashe. *F. alnifòlia*, var. *màjor*, Sims). Bushy shrub, with upright branches, to 6 ft.: lvs. broadly obovate or roundish, oval, cordate or truncate, coarsely crenate or undulate even to the base, sometimes nearly glabrous beneath, 2½–5 in. long: spikes 1½–3 in. long, with 1–3 lvs. at the base: stamens ⅓ in. long, white. B.M. 1342. L.B.C. 16:1520.—This species is superior to the former on account of its dense, pyramidal habit, larger lvs. and showier fls.

Alfred Rehder.

FOUNTAIN PLANT. *Amarantus salicifolius.*

FOUQUIÈRIA (Pierre Ed. Fouquier, professor of medicine at Paris). *Tamariscàceæ.* Candlewood. Four species of plants from the deserts of Mex. and New Mex., of which one is cult. in the larger rockeries of Calif., and is interesting as being an example of an order far removed from the Cactaceæ in fls. and fr., but reduced to something of their habit by the desert. It is often cult. by the Mexicans to make an impenetrable, spiny hedge. The plant has small and comparatively few lvs., borne in clusters in the axils of the spines. Fls. with a funnel-shaped tube 1 in. or more long, and 5 spreading lobes.

860. Fragaria Virginiana.
Showing the profuse runners.

spléndens, Engelm. Coach-whip. Vine-Cactus. Jacob's Staff. Ocotillo. Shrub, 6–10, or even 20 ft. high, branching near the base: branches long, gray, furrowed, erect: lvs. obovate, rounded at apex, wedge-shaped at base, ½–1 in. long: inflor. racemose, thyrsoid: fls. scarlet or brick-red; stamens 8–12, exserted: seeds white, with a long fringe of spirally thickened hairs. W. Tex. and Ariz. to S. Calif. A.G. 13:759.

F. Franceschi and W. M.

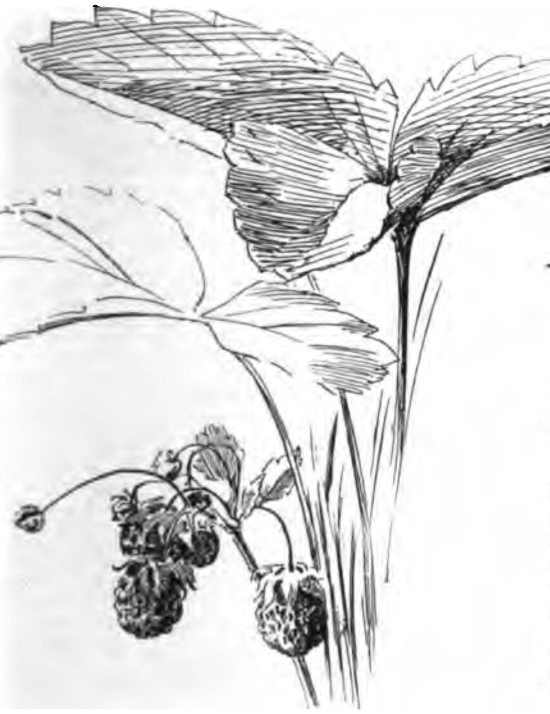
FOURCROŸA. See *Furcræa.*

FOUR-O'CLOCK. See *Mirabilis Jalapa.*

FOXGLOVE. *Digitalis.*

FRAGÀRIA (Latin *fragrare*, fragrance, from the smell of the fruit). *Rosàceæ*. STRAWBERRY. A small genus of low perennial herbs in the north temperate zone and along the American Cordilleran region. The lvs. are palmately 3-foliolate and toothed, all from the crown of the plant: fls. white or yellow, in corymbose racemes on slender, leafless scapes, sometimes lacking stamens; calyx deeply 5-lobed and reinforced by 5 sepal-like bracts; petals 5, obovate; stamens many, short; pistils many, on a conical receptacle, becoming small and hard akenes and persisting on the enlarging receptacle. The enlarged receptacle becomes pulpy and edible in the Strawberry, or Fragaria proper, but it remains small in Duchesnea. See Figs. 826, 827. Fragarias propagate naturally by means of runners.

The Fragarias are exceedingly variable. About 130 specific names have been applied to them, but there are probably not more than a dozen forms which are distinct enough to be clearly distinguished as species. Bentham and Hooker would reduce them all to three or four species. Of the true Fragarias, four species-types are interesting to the horticulturist as the parents of the garden Strawberries,—*F. Chiloensis*, the original of the ordinary cultivated Strawberries of America; *F. Virginiana*, which was early domesticated, and of which some trace still remains in cultivated varieties; *F. moschata*, the Hautbois, and *F. vesca*, the alpine and perpetual Strawberries, which are little cultivated in this country. Aside from these, the Indian Strawberry, or Duchesnea, is cultivated as a basket and rock plant. For a sketch of the evolution of Strawberries, see Essay 25, Bailey's "Survival of the Unlike." The classical work on Strawberries is Duchesne's "Histoire Naturelle des Fraisiers." 1766. See *Strawberry*.



861. Fragaria Virginiana.

A. TRUE STRAWBERRIES, *bearing an edible "berry" (or receptacle), and with a more or less upright habit: fls. white.*

B. *Lvs. normally overtopping the fls. and fr.: akenes mostly sunken in the flesh of the berry.*

Chiloénsis, Duchesne. Fig. 859. Low, but stout in all its parts: lvs. thick, more or less glossy above, bluish white below, blunt-toothed: fl.-clusters forking and long-rayed, the peduncle short, soon lopping on the ground: runners mostly appearing after the fruit is gone: berry large and firm, dark-colored, more or less musky in flavor, reinforced by a very large calyx or hull. Pacific coast region of S. Amer. A common wild Strawberry of the Pacific slope of N. Amer. is referred to this species, but it is a question whether it is identical with the S. American form.

Var. **ananássa**, Hort. (*F. ananássa*, *F. tincta*, *F. calyculàta*, Duchesne. *F. grandiflòra*, Ehrh.). PINE STRAWBERRY. COMMON GARDEN STRAWBERRY. Taller growing: lvs. larger and thinner, mostly lighter green on both sides: fr. larger, running into very many kinds.

Virginiàna, Duchesne (*F. Iowénsis* and *F. Illinoénsis*, Prince). SCARLET or VIRGINIAN STRAWBERRY. Figs. 860, 861, 862. More slender: lvs. thinner, light green above and below, the upper surface with sunken veins: fl.-clusters small, with a few hanging fruits at the top of a rather long peduncle: runners usually appearing with the fruit: berry small, light scarlet, globular or oblong-conical, usually with a constriction or neck underneath the moderate-sized calyx or hull. E. North Amer.—Variable. The larger and more hairy forms have been separated as var. *Illinoénsis*, Gray, but it is difficult to define them from the type; and the same is true of the boreal forms, which have been detached as *F. Canadensis*, Michx. A few early varieties of Strawberries, as Crystal City, seem to be wholly or partly of *F. Virginiana* origin.

862. Fruit of Fragaria Virginiana. Nat. size.

BB. *Lvs. normally shorter than the fl.-clusters: akenes usually not sunken in the flesh of the berry.*

vésca, Linn. (*F. semperflòrens*, Duchesne). ALPINE and PERPETUAL STRAWBERRIES. Erect and dark green, only sparsely hairy, the lvs. thin and light green as compared with the foregoing species, very sharp-toothed: fl.-cluster small, forking, erect: berry firm, small, usually oblong-conical, the akenes very prominent; hull spreading. Eu.—The American representative of this species—common in woods N.—is thought by some to be a distinct species, and it has received the name *F. Americana*, Britt.; but it is doubtful if it can be separated. See Figs. 863, 864. The true *F. vesca* is thought to be sparingly naturalized eastward. The native plant often bears white fruit. The cult. forms are rarely seen in this country, but the quality is high, and they are deserving of more attention in home grounds. Variable in cult. There is a form with leaflets reduced to one (*F. monophylla*, Duchesne, B.M. 63). This type of Strawberry bears more continuously than *F. Chiloensis* and *F. Virginiana*. The so-called Mexican or Everbearing Strawberry which has been introduced at times is *F. Mexicana*, Schlecht., which is another form of the vescan type. On the Pacific slope, the type possibly may be represented by *F. Californica*, Cham. & Schlecht.

moschàta, Duchesne (*F. elàtior*, Ehrh.). HAUTBOIS. Taller, usually diœcious, more pubescent, the calyx or hull strongly reflexed from the fruit: berry dull red, musky. Eu.—Cult. forms rarely seen in Amer.

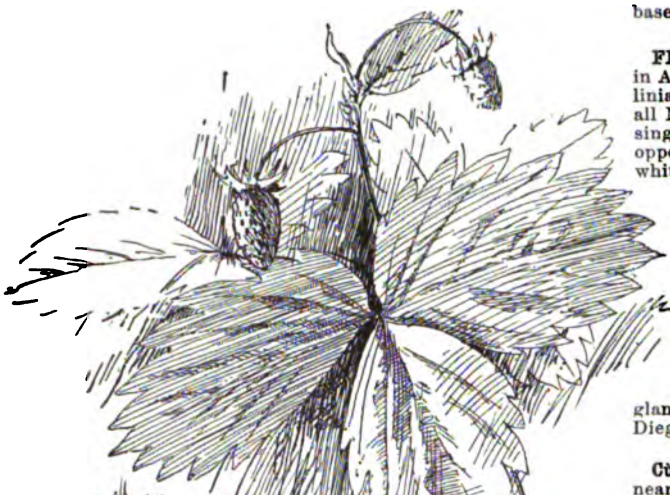
AA. DUCHESNEA. *Receptacle less fleshy, tasteless: habit trailing: fls. yellow.*

Índica, Andr. Neat trailing plant with small obovate crenate-dentate leaflets, solitary long-pedicelled fls., and calyx bracts toothed. India. Naturalized E.—Very useful as a basket trailer.

L. H. B.

FRAGRANT BALM. *Monarda didyma.*

FRAME. Fig. 865. A box without permanent top or bottom which is designed, when covered with glass or other transparent material, as a place in which to grow plants. When supplied with artificial bottom heat, the frame is part of a hotbed; when supplied only with sun heat, it is part of a coldframe. The Frame may be of any size, but the normal size is 6 x 12 ft., an area which accommodates four 3 x 6 ft. sashes; and this 6 x 12 area is understood when one speaks of "a Frame." See *Hotbed.* L. H. B.



863. Fragaria Americana (See Fragaria, page 605.)

864. Fruit of Fragaria Americana. Nat. size.

FRANCÍSCEA. Included with *Brunfelsia.*

FRANCÒA (Fr. Franco, Valencia, sixteenth century). *Saxifragàceæ.* Three species of Chilean perennial herbs, with turnip-like (lyrate) lvs. and terminal, dense racemes of white or pink fls. borne in summer. They are interesting as having points in common with Crassulaceae, Rosaceæ, Galax and even Dionæa. They grow about 2 ft. high, and in the North could perhaps be wintered in a coldframe. Scape-bearing, glandular-pilose or tomentose: rhizome thick, many-headed: lvs. glandular-dentate: fls. 1 in. across, as many as 36 in racemes 6 in. long: floral parts in 4's, rarely 5's; petals obovate, clawed.

A. *Fls. white.*

ramòsa, D. Don. Taller, woodier and more branching than the others, and distinguished by pubescent inflorescence. Leaf-stalks not margined: fls. smaller. Hardy at Washington, D. C., according to J. Saul, with spikes 2 ft. long and 1 in. thick.

AA. *Fls. mostly pink.*

B. *Leaf-stalks broadly winged at the base.*

sonchifòlia, Cav. Lower lobes continuous with the broad margin at the base of the leaf-stalk: petals deep rose, dark-spotted. B.M. 3309.

BB. *Leaf-stalks not winged at the base.*

appendiculàta, Cav. Lower lobes distant from the base of the stalk: petals pale rose, rarely spotted. B.M. 3178 (shows a white longitudinal band on petals). B.R. 19:1645, where Lindley said (1833), "It thrives better if constantly kept in a greenhouse, especially if it be planted in the open soil, where it can be freely exposed to light and air, without which the beautiful spots of its petals are scarcely developed." His plate shows 4 pretty red spots near the base of each petal. L.B.C. 19:1864, erroneously named *F. sonchifolia*, has the midveins and bases of the side veins of the petals dark red. W. M.

FRÀSERA (John Fraser, English botanist, collected in America 1785–96 and published Walter's Flora Caroliniana). *Gentianàceæ.* COLUMBO. Large, stout herbs, all North American, and all but one far-western with a single stem from thick, bitter, mostly biennial roots, opposite or whorled lvs., and cymose clusters of dull white, yellowish or bluish fls. which are commonly dark-spotted; calyx deeply 4-parted; corolla wheel-shaped, 4-parted, persistent.

A. *Lvs. in whorls of 4–6, not white-margined.*

speciòsa, Dougl. Fls. greenish white or barely tinged bluish, dark-dotted: 2 glands on each corolla lobe.—Cult. by D. M. Andrews, Boulder, Colo.

AA. *Lvs. in 2's or 3's, white-margined.*

B. *Height 2–3 ft.: fls. whitish, dark-dotted.*

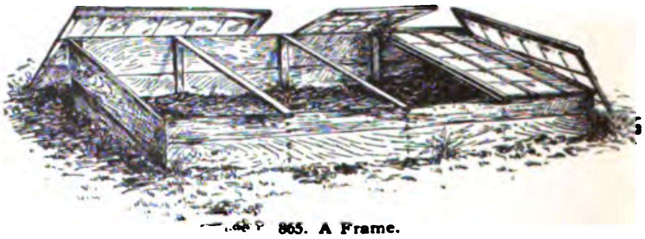
Párryi, Torr. Lvs. opposite or in 3's: 1 notched gland on each corolla lobe.—Int. 1891 by Orcutt, San Diego.

BB. *Height 3–8 in.: fls. bluish.*

Cùsickii, Gray. Lvs. opposite: 1 gland reaching from near the base to near the middle of each corolla lobe.—Adv. 1889 by F. H. Horsford, Charlotte, Vt. W. M.

FRAXINELLA. See *Dictamnus.*

FRÁXINUS (ancient Latin name). *Oleàceæ.* ASH. Hardy ornamental trees, with deciduous, opposite, pinnate, rather large lvs. and small fls. in panicles, either appearing before the lvs. and greenish, or in the subgenus Ornus after or with lvs. and whitish in showy panicles: the winged fr. is insignificant. They are valuable as street and park trees, and grow mostly into tall, pyramidal or broad-headed trees, with rather light green foliage, which turns yellow or dark purple in fall or remains green, as in *F. excelsior* and *Ornus.* The Ash is seldom severely injured, though a number of insects and fungi prey on the lvs. and wood, of which two borers, and a fungus attacking the lvs., are perhaps the most obnoxious. Most of the species are hardy North except those from the southern states, southern Europe and Himalayas; of the sub-genus Ornus, *F. Bungeana* and *F. longicuspis* seem to be the hardiest. The Ashes are important forest trees, and the straight-grained and tough wood is much used for handles of tools, in the manufacture of carriages and wagons, for the interior finish of houses, and for furniture, for baskets and also for fuel. From *F. Ornus* manna is obtained as an exudation of the trunk, and some Chinese species yield the Chinese white wax. The Ashes grow in almost any moderately moist soil, *F. nigra* being somewhat more moisture-loving, while *F. oxycarpa*, *F. Ornus*, *F. Sogdiana* and *F. cuspidata* grow well even in drier situations. They are generally readily transplanted and grow rapidly when young. Prop. by seeds gathered in fall and sown immediately, or stratified and sown in spring, covered about 1 in. high with good soil; sometimes remain dor-



865. A Frame.
It accommodates four sashes.

mant until the second year. The varieties and rarer kinds are budded in late summer or grafted in spring on the seedlings of any of the common species. About 40 species in the temperate region of the northern hemisphere south to Cuba; about 15 of the species grow in N. Amer. and nearly as many in E. Asia. Trees or shrubs, with odd-pinnate, rarely simple, opposite lvs. without stipules: fls. in panicles, diœcious or polygamous, with or without calyx or with calyx and a 2–6-parted corolla with generally linear segments; stamens generally 2: ovary 2-celled: fr. a 1-seeded, winged samara.

INDEX.

acuminata, 7.
Americana, 7.
alba, 7.
Bosci, 9.
Bungeana, 2.
Caroliniana, 12.
epiptera, 7.
excelsior, 16.
floribunda, 1 and suppl.
juglandifolia, 7.
lanceolata, 8.
lentiscifolia, 17.
longicuspis, 3.
Mandschurica, 15.
monophylla, 16.
nigra, 14.
Novæ-Angliæ, 7.
Oregona, 11.
Ornus, 1.
pannosa, 9.
parvifolia, 2, 17.
Pennsylvanica, 9.
platycarpa, 12.
potamophila, 18.
pubescens, 9.
pubinervis, 5.
quadrangulata, 13.
rotundifolia, 1 and suppl.
rufa, 16.
sambucifolia, 14.
serratifolia, 5.
Sieboldiana, 4.
simplicifolia, 16.
viridis, 8.

866. Fraxinus excelsior (× ½).

A. *Fls. with calyx and corolla perfect or polygamous. (Subgenus Ornus.)*

B. *Winter-buds gray.*

1. **Órnus**, Linn. (*F. floribúnda*, Hort., not Wall.). Small tree, becoming 25 ft.: lfts. generally 7, stalked, oblong-ovate or ovate, irregularly serrate, rufously pubescent on the midrib beneath, 2–3½ in. long: fls. whitish, fragrant, in dense, terminal panicles 3–5 in. long: fr. erect, narrow-oblong, truncate or emarginate at the apex, about 1 in. long. May, June. S. Eu., W. Asia. Gn. 48, p. 286.—Var. **latifòlia**, Ait. (*F. rotundifolia*, Hort., not Lam.). Lfts. roundish ovate or broadly ovate-oblong.

2. **Bungeàna**, DC. Small tree, to 15 ft., or shrub: lfts. generally 5, stalked, ovate, obovate or roundish, obtuse to short-acuminate, serrate, glabrous, 1–1½ in. long: panicles to 2½ in. long, many-fld. fr. narrow-oblong, obtuse or emarginate. May. China. G.F. 7:5.—Var. **parvifòlia**, Dipp. Lfts. about 1 in. long, broadly rhombic or roundish.

BB. *Winter-buds brown or nearly black.*

C. *Corolla divided to the base: stamens with rather long filaments.*

3. **longicúspis**, Sieb. & Zucc. Slender tree, to 30 ft., with rufously pubescent winter-buds: lfts. 5–7, stalked, oblong-lanceolate, long-acuminate, obtusely serrate, almost glabrous, 2–4 in. long: fls. in rather slender, narrow panicles, to 4 in. long; petals linear, acute: fr. oblanceolate. May. Japan.

4. **Sieboldiàna**, Blume. Small tree: winter-buds mostly glabrous and often almost black: lfts. 5–7, almost sessile, elliptic or oblong-lanceolate, acuminate, serrate, usually pubescent along the midrib beneath, 2–4 in. long: panicles like the former; petals linear-spatulate, obtuse: fr. oblanceolate. May. Jap., Corea.

5. **pubinérvis**, Blume. Small tree: lfts. 7–11, ovate or ovate-oblong, acute or acuminate, serrate, pubescent on the veins beneath, 1½–4 in. long: panicles less narrow than in the former: petals small and caducous. Jap. —Probably *F. serratifolia*, Hort., belongs here.

CC. *Corolla with short tube: anthers almost sessile.*

6. **cuspidàta**, Torr. Shrub or small tree, to 20 ft., with dark, reddish brown buds: lfts. usually 7, slender stalked, lanceolate or oblong-lanceolate, acuminate, coarsely serrate, almost glabrous, 1½–2 in. long: fls. fragrant, in 3–4-in. long panicles: fr. spatulate-oblong. April. Texas to Arizona and N. Mex. S.S. 6:260.—Handsome flowering tree for temperate regions.

AA. *Fls. without corolla, appearing before the lvs.*

B. *Fls. diœcious, with the calyx persistent on the fr.: anthers linear or linear-oblong: lfts. generally 5–7: buds brown. (Subgenus Leptalix.)*

C. *Fr. oblanceolate or lanceolate.*

D. *Branches and petioles glabrous.*

7. **Americàna**, Linn. (*F. Nòvæ-Angliæ*, Mill. *F. álba*, Marsh.). WHITE ASH. Fig. 867. Tall tree, to 120 ft.: lfts. generally 7, stalked, ovate to ovate-lanceolate, entire or denticulate, dark green above, glaucous beneath, 3–5 in. long: fr. linear-oblong, with terete body, the wing not decurrent, 1½ in. long. From Canada to Fla., west to Minnesota and Texas. S.S. 6:268. Em. 377.—Very variable. Var. **acuminàta**, Wesm. (*F. acuminata*, Lam. *F. epiptera*, Michx. *F. Americana*, var. *glauca*, Hort.). Lfts. dark green and shining above, very glaucous and almost glabrous beneath, entire. Var. **juglandifòlia**, Rehd. (*F. juglandifolia*, Lam.). Lfts. less shining above, usually broader, more or less pubescent beneath, serrate at least above the middle. This is the northern form, while the former is more common in the southern states. Var. **álbo-marginàta**, Hort. Lfts. edged white.

8. **lanceolàta**, Borkh. (*F. víridis*, Michx. in part. *F. Pennsylvánica*, var. *lanceolàta*. Sarg.). GREEN ASH. Tree, to 60 ft.: lfts. 5–9, short-stalked, ovate to oblong-lanceolate, irregularly serrate, green on both sides, almost glabrous, 2–5 in. long: fr. oblanceolate, with decurrent wing, hence body margined, about 1½ in. long. Canada to Fla., west to Rocky Mts. S.S. 6:272.

867. Fruit or key of Fraxinus Americana. Nat. size.

DD. *Branches, petioles and lvs. beneath pubescent, at least when young.*

9. **Pennsylvánica**, Marsh. (*F. pubéscens*, Lam.). RED ASH. Tree, to 60 ft.: lfts. 5–9, stalked, ovate to oblong-lanceolate, acuminate, crenately serrate or entire, pubescent beneath, 3–6 in. long: fr. linear-spatulate, about 2 in. long, with somewhat decurrent wing. Canada to Fla., west to Dakota and Mo. S.S. 6:271.—Var. **aucubæfòlia**, Hort. Lvs. blotched yellow, less pubescent. Var. **Bósci**,

Hort. With dark green, shining foliage. Var. **pannòsa**, Hort. Similar to the former, but lvs. larger and narrower.

10. **velùtina**, Torr. (*F. pistaciæfòlia*, Torr.). Tree, to 40 ft., with velvety pubescent, rarely glabrous branches: lfts. 5–9, sometimes reduced to 3 or even 1, short-stalked, oval to lanceolate, entire or remotely serrate, yellowish green, firm and thick at maturity, pubescent or nearly glabrous beneath, 2–4 in. long: fr. spatulate, with marginless body. Texas to Arizona and N. Mexico. S.S. 6:267.—Not hardy North.

11. **Oregòna**, Nutt. Tree, to 80 ft.: petioles sometimes glabrous at length: lfts. 7–9, almost sessile or short-stalked, oblong or elliptic, acuminate, entire or obscurely and remotely serrate, light green, 2½–6 in. long, thick and firm at maturity: fr. oblong-obovate, with decurrent wing, about 1½ in. long. Wash. to Calif. S. S. 6:276.

CC. *Fr. elliptic or broadly spatulate, body compressed with the wing all around.*

12. **Caroliniàna**, Lam. (*F. platycárpa*, Michx.). WATER ASH. Tree, to 40 ft., with pubescent or glabrous branches: lfts. 5–7, stalked, ovate or oblong, acuminate, serrate, rarely entire, pubescent or glabrous beneath, 2–5 in. long: fr. 1–2 in. long, with pinnately veined wing, often 3-winged. Virginia to Fla., west to Arkansas and Texas. S.S. 6:274–75.

BB. *Fls. without calyx (only No. 13 has a deciduous minute calyx): anthers cordate, rarely broadly oblong: lfts. generally more than 7, nearly glabrous.* (*Subgenus Fraxinaster.*)

C. *Branches 4-angled and usually winged.*

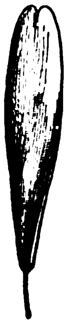
13. **quadrangulàta**, Michx. BLUE ASH. Tree, to 80, rarely 120 ft.: lfts. 7–11, short-stalked, ovate to lanceolate, acuminate, sharply serrate, yellowish green on both sides, 3–5 in. long: fls. perfect: fr. oblong, emarginate, winged all around, 1–2 in. long. From Michigan to Arkansas and Tennessee. S.S. 6:263.

CC. *Branches terete or nearly so.*

D. *Bloom diæcious: rachis at the base of lfts. with thick rufous tomentum.*

14. **nigra**, Marsh. (*F. sambucifòlia*, Lam.). BLACK ASH. Fig. 868. Tree, to 80 ft.: lfts. 9–11, sessile, oblong-lanceolate, rounded at the base, acuminate, sharply serrate, green on both sides, dark above, 3–6 in. long: anthers broadly oblong: fr. narrow-oblong, with decurrent wing. From Canada to Virginia, west to Mo. S.S. 5:264–65. Em. 382.

15. **Mandschùrica**, Rupr. Tree, to 100 ft., with obtusely quadrangular branches and dark brown buds: lfts. 9–11, almost sessile, ovate to oblong-lanceolate, sharply serrate, pubescent or hispid on the veins beneath, 3–6 in. long: fr. oblong-lanceolate, 1–1½ in. long. Manchuria, Corea, Saghalin, Japan. Valuable tree of vigorous growth.



868. Key of Fraxinus nigra. Nat. size.

DD. *Bloom perfect or polygamous: rachis without conspicuous rufous tomentum.*

E. *Buds black.*

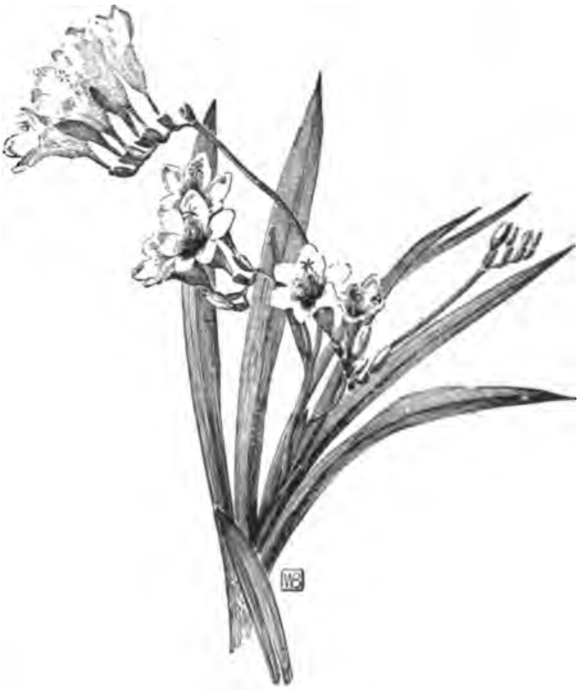
16. **excélsior**, Linn. Fig. 866. Tall tree, to 120 ft.: buds black: lfts. 9–13, almost sessile, oblong-ovate or ovate-lanceolate, acute or acuminate, serrate, dark green above, paler beneath, 2–5 in. long: fr. oblong, often emarginate, about 1½ in. long. Eu., W. Asia. Many different varieties are cultivated, some of the most distinct being the following: Var. **álbo-marginàta**, Hort. Lfts. edged white. Var. **álbo-variegàta**, Hort. Lfts. blotched white. Var. **àurea**, Loud. With yellow branches. Var. **àurea péndula**, Loud. With pendulous yellow branches, but a somewhat weak grower. Var. **asplenifòlia**, O. Ktze. (var. *scolopendrifolia*, Hort.). Lfts. very narrow, almost linear. Var. **crispa**, Willd. (var. *atrovirens*, Hort., var. *cucullata*, Hort.), with very dark green curled and twisted lvs.; of slow growth. Var. **diversifòlia**, Ait. (*F. heterophylla*, Vahl. *F. simplicifolia laciniata*, Hort. *F. rufa*, Hort., not Bosc). Lvs. simple or 3-parted, usually incisely dentate. Var. **monophylla**, O. Ktze. (*F. monophylla*, Desf. *F. simplicifolia*, Willd.). Lvs. simple, ovate, serrate, rarely with 1 or 2 small lfts. at the base. Var. **nàna**, Loud. (var. *polemoniifolia*, var. *globosa*, Hort.). A compact, slow growing, dwarf form with very small lvs. Var. **péndula**, Ait. With pendulous branches. One of the best pendulous trees for forming arbors and shady seats.

EE. *Buds brown.*

17. **parvifòlia**, Lam. (*F. lentiscifòlia*, Desf.). Shrub or small tree, to 15 ft., with slender, often purplish branches: lfts. 7–13, sessile, obovate or obovate-lanceolate, acute, serrate, 1–2 in. long: fr. oblong, obtuse or acute. W. Asia, S. Europe. Var. **péndula**, Dipp., with pendulous branches, forming a graceful small weeping tree.

18. **potamóphila**, Herd. Small tree, to 30 ft., with rather stout, upright branches: lfts. 7–13, stalked, rhombic-ovate or ovate-lanceolate, serrate, acute or acuminate, 1–2½ in. long: fr. linear-oblong, Turkestan, Songaria.

F. angustifòlia, Vahl. Allied to F. parvifolia. Lfts. oblong-lanceolate or lanceolate, serrate, to 3 in. long. S. Eu., N. Afr., W. Asia.—*F. anómala*, Wats. Small tree, to 20 ft., with quadrangular branches: lvs. simple or pinnate, roundish or roundish ovate, 1½–2 in.: fr. obovate. Colo., Utah. S.S. 6:266.—*F. argéntea*, Loisel., is a var. of F. rotundifolia, but in gardens often other Ashes, especially varigated forms, are cult. under this name.—*F. Berlandieriàna*, DC. Allied to F. lanceolata. Tree, to 70 ft.: lfts. 3–5, ovate or obovate, serrate, downy along the veins beneath, to 4 in. long. Texas to Mexico. S.S. 6:273.—*F. Biltmoreàna*, Beadle. Allied to F. Americana. Tree, to 50 ft.: branches pubescent: lfts. 7–9, oblong-lanceolate, pubescent beneath, 3–6 in. long: fr. 1½–2 in. long, emarginate, with elliptic, marginless body. N. Carolina.—*F. dimórpha*, Coss. & Dur. Allied to F. xanthoxyloides. Shrub: lfts. 5–7, roundish ovate to oblong, crenately serrate, ½–1 in. long. N. Africa. Tender.—*F. dipétala*, Hook. & Arn. Allied to F. cuspidata. Shrub: lfts. 5–7, elliptic or ovate, serrate or entire, ½–2 in. long: fls. with 2 obovate petals. Calif., Mexico. S.S. 6:261. Tender.—*F. floribúnda*, Wall. Allied to F. longicuspis. Tree, to 40 ft.: lfts. 5–7, ovate-lanceolate, serrate, reticulate beneath, 2–4 in. long: panicles large, to 10 in. long: petals oblong. Himalayas. Tender.—*F. Gréggi*, Gray. Allied to F. cuspidata. Small tree: lfts. 3–7,

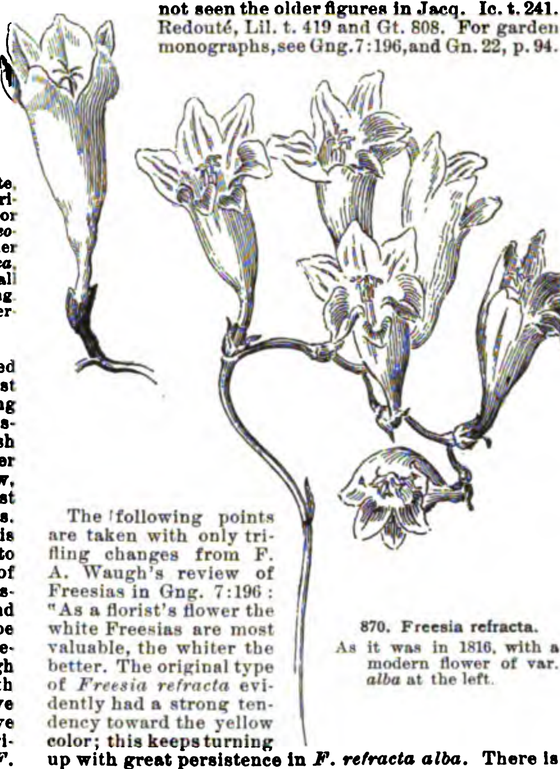


869. Freesia refracta, var. Leichtlinii.

oblong-obovate, crenately serrate, or entire, ½-1 in. long: fr. linear-oblong, emarginate. S.S. 6:262. G.F. 2:451.—*F. Marièsi*, Hook. f. Allied to F. Bungeana. Shrub: lfts. 5, almost sessile, obovate to ovate-lanceolate, entire or serrate, acute, 1–3 in. long. China. B.M. 6678.—*F. oxycárpa*, Willd. (F. oxyphylla, Bieb.). Allied to F. parvifolia. Tree, to 60 ft.: lfts. 5–11, lanceolate, serrate, pubescent along the midrib beneath, 1½–3 in. long: fr. oblanceolate, acute. S. Eu., W. Asia.—*F. profúnda*, Bush. Allied to F. Pennsylvanica. Lfts. 7–9, oblong-lanceolate, acuminate, entire, 3–6 in. long, tomentose beneath: fr. 2–2½ in. long, with decurrent wing. Ark., Mo.—*F. raibocárpa*, Regel. Shrub: lfts. 3–7, oblong or oblong-obovate, usually entire, obtuse, 1-2 in. long: fr. strongly falcate, with obovate not decurrent wing. Turkestan, Buchar.—*F. Régeli*, Dipp. Probably only var. of F. potamophila, with darker green, broader and less acute lfts. Turkestan.—*F. rhynchophýlla*, Hance. Large tree: buds large, thickly covered with rufous tomentum: lfts. 5, oblong-obovate, remotely crenate-serrate, 2–4 in. long: fls. perfect, apetalous, with a calyx. China. G.F. 6:485.—*F. rotundifòlia*, Lam. Allied to F. Ornus. Small tree, to 25 ft.: lfts. 5–9, roundish or roundish obovate, irregularly serrate. S. Europe.—*F. Sogdiàna*, Bge. Allied to F. angustifolia. Small tree: lvs. often in 3's and rather crowded; lfts. 3–5, lanceolate, serrate, 2–4 in. long. Turkestan.—*F. tamariscifòlia*, Vahl. Allied to F. parvifolia. Small tree: lfts. 9–11, short-stalked, oblong-lanceolate, serrate, 1–3 in. long. W. Asia.—*F. Texénsis*, Sarg. Allied to F. Americana. Tree, to 40 ft.: lfts. 5, broadly oval or ovate, rounded or acute at the apex, 1½–2½ in. long. Texas. S.S. 6:270.—*F. Theophrásti*, Nouv. Duh., is a var. of F. Ornus, but in gardens other forms are sometimes cult. under this name.—*F. Turkestánica*, Carr.—F. Sogdiana.—*F. xanthoxyloìdes*, Wall. Shrub or small tree, to 25 ft.: lfts. 5–9, oblong, crenulate-serrate, 1–2 in. long. Himalayas. Belongs to the subgenus Sciadanthus, having perfect apetalous fls. with calyx.

Alfred Rehder.

FREÈSIA (the author of this genus never explained the name). *Iridàceæ*. Freesias (Fig. 869) are amongst the dozen most popular bulbous plants for fall planting and winter blooming, and next to the Chinese narcissus, which can be grown in pure water, they flourish in home windows with less care than most other bulbs. They have tubular fls., white or pale yellow, borne in a pretty fashion that makes them amongst the most highly individualized of all garden plants. The 5–7 fls. are upright and strung along a jointed axis which is suddenly bent back almost at right angles to the vertical peduncle. (This habit is an accentuation of that of Tritonia, from which Freesia is essentially distinguished by the 2-cut style.) Of the splendid and almost numberless bulbs from the Cape of Good Hope (including the iris, amaryllis, and lily families) Freesias are, next to gladiolus, the most popular, though not so variable as Ixias. This popularity is a growth of the last quarter century or less, though Freesias have been in cultivation since 1816 or earlier. Conservative botanists now suppose that the Freesias are all originally of one stock, which species should be called *F. refracta*. The extremes of variation in form are shown in Figs. 869 and 870, from the long and slender tube of var. *alba* to the short and broader tube of var. *Leichtlinii*. One of the earliest pictures of the plant is that in the Botanical Register for 1816 (Plate 135, as *Tritònia refrácta*), a part of which is reproduced in Fig. 870 to show the great irregularity of the corolla lobes at that early period, and the straggling habit of the fls., some pointing down and others up. The colors in the plate are unattractive, almost repulsive, being a sickly green throughout, with a strong orange color on the tips of the 3 lower lobes. The garden evolution of the Freesias has proceeded along two lines. The greatest effort has been expended to produce a pure white flower, and in the best strains the white color is mostly associated with a long and slender tube. The ideal of a yellow flower is less popular, and is mostly associated with the shorter and broader tube. In both cases the forms with straggling inflorescence and irregular corolla lobes have been relentlessly suppressed. One may easily see how strongly 2-lipped and gaping were the flowers of 1816, and how strongly the tube was bulged upon one side. Any tendencies toward such forms in modern bulbs are signs of degeneration or carelessness somewhere. In pedigree plants the lobes are beautifully rounded and the flowers symmetrical. Perhaps the most charming picture of the two prevailing ideals is Plate 347 of the Garden, vol. 22, 1882. One of the earliest pictures of the short- and broad-tubed yellow type is that in L.B.C. 19:1820, published in 1832 as *Tritònia odoràta*. The probable course of evolution and degeneration in Freesias is pictured in Gng. 7:197 and A.F. 14:1179. In the pursuit of either ideal, the yellow spots have been considered objectionable. The original stock seems to have a trace of violet color, which sometimes shows itself in varying intensity, sometimes in spots or lines, sometimes in a suffused tint. Lately some fine effects are said to have been secured with this minor color, but it is doubtful if the violet hue will ever produce anything of the first importance. Less important pictures of Freesias are in Mn. 8, p. 87. A.G. 17:539. Gn. 51, p. 304. G.C. III. 3:588; 19:391, 392, 397. The writer has not seen the older figures in Jacq. Ic. t. 241. Redouté, Lil. t. 419 and Gt. 808. For garden monographs, see Gng. 7:196, and Gn. 22, p. 94.



870. Freesia refracta.

As it was in 1816, with a modern flower of var. *alba* at the left.

The following points are taken with only trifling changes from F. A. Waugh's review of Freesias in Gng. 7:196: "As a florist's flower the white Freesias are most valuable, the whiter the better. The original type of *Freesia refracta* evidently had a strong tendency toward the yellow color; this keeps turning up with great persistence in *F. refracta alba*. There is always a certain per cent of yellow mixture, even in the finest strains. Sometimes it is only 2–3 per cent; sometimes it is 50 per cent; usually it runs about 5–10 per cent. The causes of this are not certain. A Californian makes a quasi admission of the allegation that American grown stock shows more yellow than the European grown, and suggests that the strong sunlight of his state accounts for the tendency toward yellow fls. Experiments by V. A. Clark show that the yellow color is formed under the direct oxidizing influence of sunlight. In general it seems that the greater amount of yellow is correlated with stronger growth. Plants which grow very vigorously show darker green leaves and more of the peculiar sulfur color. White flowers are often, like white leaves, a sign of weakness in the plant. This makes it difficult to keep a stock of Freesias vigorous and at the same time selected to a high degree of purity as regards the flowers."

Freesias are much forced by florists, chiefly for cut-flowers at Christmas. If cut when only 2 fls. are out, the rest will open. They can be had in flower from Christmas until June by successional plantings from Aug. to Feb. For the best results the largest and highest priced bulbs should be planted as early as Aug. One of the strong points of Freesias, however, is that planting may be delayed longer than with many other bulbs. Bulbs may be dried off gradually in the pots and kept dry during summer. Repot; the larger bulbs will bloom, but will not give so good results as medium size imported bulbs not previously forced.

In the home window Freesias will flower in 6 weeks after growth starts. Their fragrance is delightful. They are not so particular as the other important bulbs about being potted long before they are wanted for forcing and stored in a cool place, where the tops are held back while the roots develop. Be careful to have good drainage. There is danger of overwatering until the plants are in flower.

The wholesale production of Freesia bulbs is an important industry. The Channel Islands have long been known as one of the most favored localities for growing Cape bulbs. Freesias are comparatively little grown in Holland. The centers of the industry seem to be shifting. The Bermuda Islands now have a small share of the trade, and California has the largest share of any of the American states at present.

A. *Fls. distinctly 2-lipped: inflorescence straggling: colors dull; spots prominent.*

refrácta, Klatt. Fig. 870. The original type no longer in cultivation. Lvs. linear: spathe-valves small, oblong-lanceolate, scarious.

AA. *Fls. and inflorescence more nearly regular: colors purer; spots not prominent.*

B. *Tube typically long, slender and gradually narrowed.*

Var. **álba**. Fig. 870. Lvs. and spathe-valves as in var. *odorata*.

BB. *Tube typically short, broad, suddenly constricted.*

C. *Color pale yellow.*

Var. **Leichtlinii**. Fig. 869. There is a subvariety *major* int. by Sutton.

CC. *Color bright yellow.*

Var. **odoráta**. Lvs. broader and less rigid than in the type: spathe-valves broader and more obtuse. Subvarieties with various colors are *láctea*, *lilacína*, *formósa* and *Klatteána*.

CCC. *Color orange.*

Var. **áurea**. Odorless, later than the rest and more uncertain.

Other kinds of less importance are *crispa*, *tricolor*, *xanthospica*, *purpurascens* and *xanthospila*. These names do not appear in American catalogues. Bella is a variety highly praised by some.

W. M.

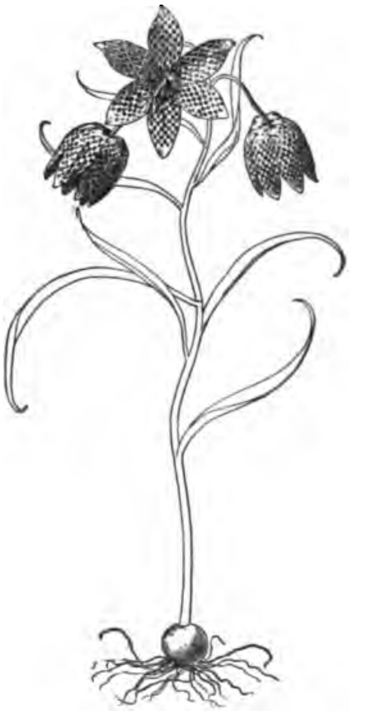
FREMÓNTIA (after John Charles Fremont, distinguished western explorer, who discovered it in 1846). Syn. *Fremontodéndron*. *Sterculiáceæ*. Beautiful free-flowering shrub, with alternate, rather small, palmately-lobed lvs. and large yellow fls. appearing in great profusion in June. It is not hardy North, and in cool regions it should have a sunny and sheltered position, preferably against a wall of southern aspect; it prefers well-drained, rather dry soil, and dislikes, especially during the winter, an excess of moisture. Prop. by seeds or by greenwood cuttings under glass in summer. One species in California, allied to the Mexican Cheiranthodendron: shrub or small tree, with stellate pubescence: lvs. alternate, slender-petioled: fls. solitary on short, lateral branchlets, apetalous; calyx large, deeply 5-parted, with 3 small bracts at the base; stamens 5-connate toward the base into a tube: fr. a 5-celled, dehiscent capsule with many seeds.

Califórnica, Torr. To 20 ft.: lvs. generally roundish ovate, cordate or rounded at the base, obtuse, 3- to 5-lobed or almost entire, whitish or ferrugineous pubescent beneath, ¾–1½ in. long: calyx 1½–3 in. across, deep yellow, with stellate hairs outside, villous at the base within; lobes orbicular: capsule densely beset with hispid hairs, 1 in. long. S.S. 1:23. B.M. 5591. Gn. 3, p. 55; 29:525 and 33, p. 566. F.S. 22:2349. R.H. 1867:90. I.H. 13:496. B.H. 17:13.

ALFRED REHDER.

FRINGE TREE. *Chionanthus Virginica.*

FRITILLÁRIA (Latin *fritillus*, commonly understood to be a checker-board, but may have meant dice-box). *Liliáceæ*. This genus includes the Crown Imperial and the Fritillaries, hardy, bulbous plants, mostly low-growing and spring-blooming, with drooping or nodding fls. which are often checkered or tessellated with dark purple and green, but some also have brighter colors. They resemble lilies in having drooping or nodding fls., but their anthers are fixed at the base, while those of the lilies are fastened on the back but are free to swing about. Lilies, too, have funnel-shaped fls., while Fritillaries and tulips have bell-shaped fls., and tulip fls. are erect. Nearly all the Old World Fritillaries resemble tulips in having coated bulbs, while all the American Fritillaries resemble lilies in having scaly bulbs. It is a curious fact that the Cape of Good Hope, which has supplied the world with so many excellent bulbous plants, has no lilies, tulips or Fritillaries.



871. Common Snake's-head or Checkered Lily. (Fritillaria Meleagris.)

Faithfully redrawn from Besler's Hortus Eystettensis, published in 1613. (Incorrect as to stamens and pistil.)

By far the most popular kinds are the Checkered Lily and Crown Imperial, Figs. 871, 874. These are the hardiest, the easiest to cultivate and the most variable. The Crown Imperial is one of the most characteristic plants of old-fashioned gardens, but it has been banished from many modern gardens because of its strong fœtid odor. It is the most robust of all the species, and until 1897 was supposed to be the only one with its fls. in umbels, all the others being solitary or in racemes. It is a truly imperial plant, and rejoices the children early in every spring by its marvelous pearly drops of nectar, which seem never to fail. *F. Meleagris*, the most popular of the purple kinds, is the common Snake's Head or Checkered Lily, so called from the tessellation of purple and green, which is prettiest when as sharply and regularly defined as possible. This plant grows wild in moist English meadows, and can be naturalized in large quantities in such situations. It is the only kind that can be used for all the purposes mentioned below and for cut-fls. Other ancient inhabitants of European gardens are *F. latifolia*, *lutea* and *Persica*, for the last of which we are indebted to "Mr. Nicholas Lete, a lover of all fair flowers," by whose "procurement," Parkinson says, it was secured through Turkey. All the remaining kinds are rarer.

As a rule, the kinds that are chiefly purple or green, or mixtures of both colors, are dull, unattractive and curious compared with the few kinds that have brilliant yellow or red. Of the duller and purple kinds, 2 of the choicest, next to *F. Meleagris*, are *F. tulipifolia* (which is flamed like a tulip and never checkered) and *F. Camtschatcensis*, great masses of which in Alaska make one of the "summer sights" remembered by the tourists. The white in Fritillaries is perhaps always more or less greenish, and the white color in *F. Meleagris* is as good as in any species. By far the most brilliant of the genus is *F. recurva*, which is also the most difficult of culture. Next in brilliancy come *F. lutea*, *aurea*, *Moggridgei* and *pudica*, all highly individual and all yellow, some checkered, others not.

The culture of Fritillaries is rather complicated, 2 kinds capable of being naturalized, some cult. in borders, some in rockeries and others in pots. The Crown Imperial, being exceptionally vigorous, requires the deepest planting, richest soil and most room. The earth should be trenched. Well rotted manure may be worked into the soil 6 in. below the bulbs and the bulbs set on a level 6 in. from the surface of the ground. This species has the largest fls. in the genus. If possible it should be shaded from the midday sun, as southern exposures are said to make the fls. smaller and shorter lived.

In border cultivation the essential peculiarities are a sheltered, shady site, early fall-planting, division every 2 or 3 years, and as a rule a warm, deep, sandy loam, which is not too cold or too retentive of moisture. Bulbs of the taller kinds may be planted 3–4 in. deep; bulbs of the dwarf kinds may be set at half that depth. As all Fritillaries increase rapidly by offsets, it is desirable to lift and divide the plants at least every 3 years, or the small bulbs will rob the big ones. For the same reason Fritillaries are rarely prop. by seeds.

The dwarf and rare sorts require more care and deserve some leaf-mold in their soil. "E. J.," in Gn. 52, pp. 242–244, says that such plants require an evergreen carpet through which they may spring, and recommends *Sedum Hispanicum* or its var. *glaucum* as the most perfect carpet possible, taking the least from the soil and giving the least possible resistance to the plants below. "Such carpets must of necessity be plants of very dwarf, creeping growth, such as some of the smaller, mossy saxifrages or aubrietias, that do not mind frequent disturbance and are easily replaced." For the principles of culture in rockeries and pots, see *Alpine Gardens* and *Bulbs*.

Our native Fritillaries, which include the bright-fld. *recurva* and *pudica*, are confined to the Pacific coast. Of these Carl Purdy makes 2 cultural groups, based on the character of bulb, the kind of soil and the conditions of shade. The first group contains *F. biflora*, *liliacea* and *pluriflora;* the second *F. atropurpurea*, *coccinea*, *lanceolata*, *parviflora*, *pudica* and *recurva*. The former grow in open fields in heavy clay soils; the latter in shady woods, in well drained soils, but *F. pudica* does not need as much shade as the others of its group, and must have sandy loam and slight shelter. It is a native of the sandy sage brush region, east of the Sierra Nevada and Cascade Mts. The bulbs of the first group are composed of thick, heavy scales attached to a thin, rhizomatous base; in the second group the bulbs are of one piece, and low-conical in form, their sides thickly covered with small, round, white rice-like offsets. For the first group Purdy recommends a rich loam, and a slight shade to draw out the stems and prolong the bloom; for the second group a light, loose soil, rich in mold, a sheltered place and considerable shade. At the best these are not profuse in their bloom. E. J. advises that the bulbs of *F. recurva* should be planted with the least possible delay.

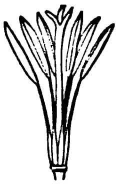
The key to the various subgenera given below is essentially Baker's in his monograph in Latin in Jour. Linn. Soc. 14:251 (1875); it rarely happens that the botanical and horticultural interests agree in using such simple and obvious characters as those of the bulb and style. The nectaries or glands are less useful and reliable, but they help to give a sense of the natural groups in this large genus.

A. *Bulbs tunicated* (i.e., *coated*).
B. *Style 3-cut.*
D. *Glands distinct and prominent, equal.* Species Subgenera
E. *Glands long*............ 1. EUFRITILLARIA
EE. *Glands wide*............2–14. MONOCODON
DD. *Glands obscure, equal, long*...................... NOTHOLIRION
BB. *Style undivided.*
C. *Glands equal, obscure* ....15–17. AMBLIRION
CC. *Glands unequal, prominent.*
D. *Glands long* .... 18. KOROLKOWIA
DD. *Glands short* .... RHINOPETALUM
AA. *Bulbs scaly.*
B. *Style undivided* ....19–20. THERISIA
BB. *Style 5-cut.*
C. *Capsules acutely angled.*
D. *Fls. solitary or racemose*...................22–25. GONIOCARPA
DD. *Fls. in umbels*........... 26. PETILIUM
CC. *Capsule obtusely angled* ..27–30. LILIORHIZA

INDEX.

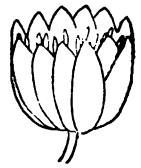
Armena, 16.
atropurpurea, 24.
aurea, 9.
biflora, 29.
Camschatcensis, 30.
coccinea, 25.
delphinensis, 3.
Elwesii, 14.
Imperialis, 26.
Kamschatcensis, 30.
lanceolata, 22.
latifolia, 7.
Libanotica, 20.
liliacea, 28.
lutea, 8.
Meleagris, 1.
meleagroides, 11.
minor, 11.
Moggridgei, 3.
Oranensis, 13.
pallidiflora, 10.
parviflora, 23.
Persica, 19.
pluriflora, 21, 27.
pudica, 17.
Pyrenaica, 12.
recurva, 27.
Raddeana, 26.
Ruthenica, 6.
Sewerzowi, 18.
Thunbergi, 4.
tubæformis, 3.
tulipifolia, 15.
verticillata, 4.
Walujewi, 5.
Whittalli, 2.

1. **Meleàgris**, Linn. Figs. 871–873. Distinguished from No. 2 by the glands 5–6 lines long and stigmas half as long as the style. Typically 1-fld. England and Norway, through central Eu. to Caucasus. Gn. 32:626; 47, p. 330; 52, p. 243.—In the English meadows whitish and purplish forms are found which are more or less checkered. The Dutch bulb-growers keep at least 10 kinds distinct. The extremes of color-range are (1) a greenish white, (2) a sufficient degree of purple to make the checkering as distinct as possible, and (3) an approach to yellow. Some kinds bear 2–3 fls.; some are double; some fls. spread so widely as to be almost funnel-shaped. Var. **contórta**, an old monstrosity, instead of segments free all the way, and a shouldered base, has the lower third of the perianth united into a funnel-shaped tube. The yellow of some fls. is conjectured to be the result of a cross with *F. lutea* made before Gerarde's time, say 1630. In England the species flowers toward the end of April. It is the best "all-round" species.



872. Stamens and pistil of Fritillaria Meleagris.

From Flora Danica, showing the 3-cut stigma, an important character in this genus.



873. Strange form of doubling in the Checkered Lily.

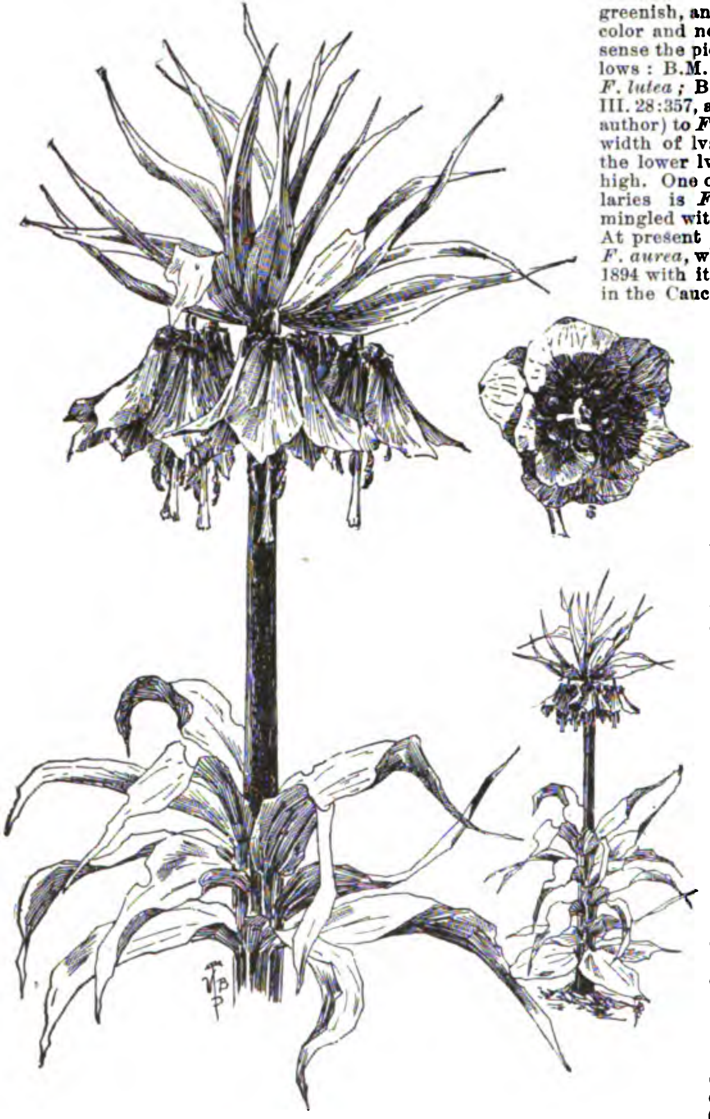
Pictured as early as 1613.

2. **Whittallii**, Baker. Height 1 ft.: stem 1-fld.: lvs. linear, glaucous: fls. checkered green and brown. Mt. Taurus. Int. 1893.

3. **tubæfórmis**, Gren. & Godr. (*F. delphinénsis*, Gren.). Distinguished by the glands 3–4 lines long and very short stigmas. Alps. Baker gives the same color range as for *F. Meleagris*, but "D.K.," in Gn. 32, p. 537, regards as the typical color a purplish brown, faintly marked with yellow, belonging to a plant that fls. in July. However, the most desirable form is var. **Móggridgei**, Boiss. (*F. Móggridgei*, Hort.), with its bright yellow, checkered inside with bright red or reddish brown. This is a dwarfer form from the maritime Alps, with wider lvs. (6–9 lines), longer stigmatic cusps, approaching *F. lutea*, and essentially yellow-fld. G.C. II. 13:532. Gn. 18:244. F.M. 1880:405.—It blooms in mid-April. Var. **Burnàti**, Planchon, bright plum, checkered

greenish yellow ; has a broadly bell-shaped, smaller fl., which is even earlier and has smaller glands.

4. **verticillàta,** Willd. (*F. leucántha*, Fisch.). This and No. 5 are distinguished from Nos 6–10 by the greater height of the former and their lvs. curled at the tips into tendrils. Height 1½ ft.: stems often 1-, sometimes 2–5-fld.: fls. white or yellow, never checkered or spotted. Altai Mts. B.M. 3083.—In the type the lvs. are numerous, 20–40 ; anthers barely half as long as the filaments: style no longer than the ovary, but in var. **Thùnbergii** (*F. Thùnbergii*, Miq.) the upper lvs. are often sparse : anthers as long as the filaments ; style 1½–2 times as long as the ovary. G.C. II. 13:532. It is doubtful if the yellow-fld. form is cult.



874. Crown Imperial—Fritillaria Imperialis.

5. **Walujèwi,** Regel. Probably belongs here, as its lvs. have tendrils. It is the only kind that is silver-white outside and crimson-brown spotted white or yellow inside. Turkestan. Gn. 52:1137.

6. **Ruthénica,** Wickst. Height 1–2 ft.: stem 1–3-fld.: lvs. 6–20: fls. livid purple, obscurely checkered. Caucasus.

7–9. **latifòlia,** Willd., and its allies **F. lùtea,** Miller, and **F. aùrea,** Schott. These three names may be taken as representing the 3 well-marked types of color: *F. latifolia* representing the extreme of dark purple and green without yellow ; *F. aurea*, at the other extreme, being essentially yellow, the checker marks smaller and more sharply defined, and the colors of the brightest ; *F. lutea* an intermediate form, essentially yellow, but greenish, and with the purple checker-marks duller in color and not so sharply defined and regular. In this sense the pictures may be referred to the types as follows : B.M. 853 and 1207 to *F. latifolia ;* B.M. 1538 to *F. lutea ;* B.M. 7374, R.H. 1878, p. 287, Gn. 42:867, J.H. III. 28:357, and probably Gt. 840, Fig. 1 (not seen by the author) to *F. aurea*. *F. latifolia* represents the extreme width of lvs., and *F. aurea* is said to differ in having the lower lvs. often whorled. All these grow ½–1 ft. high. One of the most anciently cultivated of all Fritillaries is *F. lutea*, which is found promiscuously mingled with the wider-leaved form, both wild and cult. At present the most popular of the three is probably *F. aurea*, which began a new era of prosperity about 1894 with its reintroduction by Leichtlin. All flourish in the Caucasus region. The Dutch bulb-growers advertise 10 varieties of *F. latifolia*.

10. **pallidiflòra,** Schrenk. Allied to 1 and 12, but with more numerous, broader lvs., and larger fls. Height 6–15 in.: lvs. 8–25: fls. 1–6. Siberia. B.M. 6725 (green, with a few dark purple spots). Gt. 1857:209. R.H. 1880, p. 215. G.C. II. 19:573.—"Pale yellow." *Van Tubergen*.

11. **meleagroides,** Patrim. (*F. minor*, Ledeb.). Height 1–2 ft.: stem very slender. mostly 1-fld.: lvs. 3–6, narrowly linear: fls. dark purple, spotted green; anthers a third the length of the filaments. W. Siberia. B.M. 3280.

12. **Pyrenàica,** Linn. Height 1–1½ ft., mostly 1-fld.: lvs. 6–10, linear, glaucous: fls. dark purple, spotted green ; anthers two-fifths the length of the filaments. Pyrenees. B.M. 664, not 952 or 1216.

13. **Oranénsis,** Baker. Height 1–1½ ft.: lower lvs. lanceolate: upper lvs. linear: fls. dark purple, obscurely checkered green. Mt. Oran. G.C. II. 13:341.

14. **Élwesii,** Boiss. Lvs. 5–6: fls. green, flushed purple on back and tips, not checkered. Lycia. B.M. 6321, erroneously, as *F. acmopetala*.

15. **tulipifòlia,** Bieb. One of the choicest and daintiest kinds. Very distinct. Foliage glaucous blue: fls. resembling a tulip in shape, and with a chalky look outside. Height 2–8 in.: stem 1-fld.: lvs. 3–4, elliptic, concave, nerveless, 1½–2½in. long: fls. solitary, inside rusty brown-purple, not checkered, outside dark glaucous blue, streaked with the same purple. Caucasus. B.M. 5969.

16. **Armèna,** Boiss. Height 6–12 in.: stem 1-fld.: lvs. 4–5, lower lanceolate, upper linear: fls. between funnel- and bell-shaped, dark purple, not checkered. Armenia. B.M. 6365. J.H. III. 35:83. Var. **fùsco-lùtea,** Hort., tawny yellow.

17. **pùdica,** Spreng. Lvs. 3–6, lower ones strap-shaped, often opposite (while in *F. tulipifolia* and *Armena* they are alternate), upper ones linear: fls. pale or dark yellow, rarely purple, never checkered. N. W. Amer. Gn. 13:133. R.H. 1895, p. 229. G.C. III. 19:403. J.H. III. 32:295. Mn. 4:49.—The stamens (as in Nos. 14 and 15) are nearly as long as the perianth. "Deep orange yellow, fragrant." *Van Tubergen*.

18. **Sewérzowi,** Regel. Height 1–1½ ft.: lowest lvs. lorate-lanceolate, 1 in. wide, often opposite, upper lvs. lanceolate, 6–7-nerved, 3–4 in. long: pedicels 3–6 lines long: fls. 6–10, green, not checkered, but with a few purple spots outside; filaments purple; anthers green.

Turkestan. Gt. 760. B.M. 6371. J.H. III. 30:319. G.C. III. 1:457.

19. **Pérsica,** Linn. Robust, 2–3 ft. high: lvs. 40–60, glaucous, linear, 4–6 in. long, 6–9 lines wide: raceme 10–50-fld.: fls. small, bell-shaped, slightly odorous, lilac-purple, sometimes chalky outside and lined with purple but never checkered; stamens a trifle shorter than the perianth. Orient. Fls. end of April or beginning of May. B.M. 1537. Var. **minor,** Sims, B.M. 962 (excluding synonymy), has smaller fls. and anthers barely exserted.

20. **Libanótica,** Baker. Closely resembling No. 19, but with 6–30 strongly odorous fls., pale lilac, with darker vertical veins; stamens a third shorter than the perianth; anthers purplish. Palestine, rocky and shady parts of Mt. Lebanon.

21. **pluriflòra,** Torr. Height 1–1½ ft.: lvs. 8–12, lowest often opposite, oblanceolate, the rest narrower: raceme 4–12-fld.: fls. rosy purple, not checkered. Calif. G.C. III. 21:23 (a central band of purple down each segment).—"Pale reddish purple." *Van Tubergen.*

22. **lanceolàta,** Pursh. This and Nos. 23–25 are natives of W. N. Amer., and grow 1–1½ ft. high. Stem 1–3-fld.: lvs. 4–10, lanceolate, whorled: fls. pale purple, mostly distinctly checkered Var. **grácilis,** Hort., dark purple.

23. **parviflòra,** Torr. Stem 5–20-fld.: lvs. about 9, linear: fls. purple, suffused green, not checkered.

24. **atropurpùrea,** Nutt. Stem 1–6-fld.: lvs. 12–20: fls. dark purple obscurely checkered with green. Recent. —Said to rival *F. recurva.*

25. **coccinea,** Greene. Stem 1–4-fld.: lvs. 4–12 in 2 or 3 whorls at middle of stem: fls. yellow and scarlet. checkered.

26. **Imperiàlis,** Linn. (*Imperiàlis coronàta,* Dum. Cour.). CROWN IMPERIAL. Fig. 874. Height 2–3 ft.: lvs. numerous, crowded, ascending, ½–1 in. wide, highest often in whorls of 8–10: fls. end of March. B.M. 194 and 1215. Gn. 46, p. 101 and 52, p. 243. A.G. 13:488. R.B. 20:196.—There are single and double forms in yellow and red, and kinds with foliage striped white, and with gold. The Dutch growers also advertise Aurora, Maximus, and William Rex, red; Sulphureus, sulfur yellow; and Crown upon Crown. American dealers add Couronne Orange and Red Slagzwaard. Var. **longipétala,** Hort. Gn. 56:1247. For more than a century *F. Imperialis* has been the only species in cult. with fls. in umbels, but Max Leichtlin writes to G.F. 7:177 (1897), that *F. Raddeàna* belongs to the same group, blooms earlier, and has straw-colored fls. of a different form from *F. Imperialis,* and adds: "This is likely to cause a revolution in the Imperialis strain when once it has been carefully hybridized."

27. **recúrva,** Benth. This has stamens only a little shorter than the perianth, while in the next 3 species they are only half the length of the perianth. Utterly distinct from all other Fritillaries by the color of the fls., which are bright red outside without a trace of purple, and brilliant yellow inside, spotted with red. Height 6–24 in.: stem 2–8-fld., purple, mottled green: lvs. 6–12, lower ones in whorls of 3–4, linear, ascending: fls. narrow, bell-shaped. Calif. B.M. 6264. Gn. 18:257. Var. **pluriflòra,** Hort., is perhaps the best strain.

28. **liliàcea,** Lindl. Height 6–12 in.: stem 1–6-fld.: lvs. 9–15: fls. between funnel- and bell-shaped, whitish, veined green, not checkered. Gt. 1871:715.

29. **biflòra,** Lindl. Height 6–9 in.: stem 1–2-fld.: lvs. 4–8: fls. same shape as in *F. liliacea,* pale purple, suffused green, scarcely checkered.

30. **Camtschatcénsis,** Ker-Gawl. Mostly written *Kamtschatcensis* and variously misspelled. (*Lílium Camtschatcénse,* Linn.). BLACK LILY. Height 6–18 in.: stem 1–3-fld.: lvs. 10–15, dark purple. Siberia, Alaska to Calif. Gn. 25:432; 52, p. 242. F.S. 12:1232.

F. citrina is cult., but little known. See Gn. 52, p. 243.

W. M.

FRŒLÍCHIA (J. A. Frœlich, physician of Ellwangen, monographed Gentiana, 1796, died 1841). *Amarantàceæ.* Eight species of woolly or hairy North American annuals, found chiefly in West Indies, Mex. and Brazil. Lvs. opposite: spikes opposite, terminal: fls. perfect, 3-bracted; calyx tubular, 5-cleft, hardened and spiny crested in fr. **F. Floridàna,** Moq., has been advertised for sale only rarely in America. It is cult. abroad. Height 1–3 ft.: lvs. linear to oblong: spikes 2 in. long or more: fls. white and woolly, set off by small blackish bracts. July–Sep. B.M. 2603, as *Oplotheca Floridana.*

W. M.

FROG-BIT in America is *Limnobium;* abroad *Hydrocharis Morsus-ranæ.*

FROST. The hoar Frost which injures plants is frozen dew. An object cools at nightfall and the moisture of the air condenses upon it, forming dew. If the temperature then falls below the freezing point, Frost results. Frost is a local phenomenon. It ordinarily occurs in the lower places where the cold air settles; also when the sky is clear, since radiation of the earth's heat is then more rapid. It occurs in still nights when currents of air of varying temperatures are not set in motion. Frosts must be distinguished from freezes. The latter are wide-area disturbances. They are associated with storm centers. They often occur over a wide range. They frequently accompany high winds. Frosts can often be prevented, but freezes are usually beyond the control of man.

Frost is prevented when the temperature is not allowed to fall below the freezing point. The temperature is usually controlled by indirect means. The greatest immunity is to be expected when an artificial cloud can be spread over the area. This cloud prevents the radiation of the earth's heat, and thereby prevents the rapid fall of temperature. The basis of this artificial cloud is usually smoke, but if the smoke carries with it a large amount of vapor of water, it will afford a more complete protection. The best material for making the smoke-cloud is something which will burn with a slow, smouldering fire and afford quantities of smoke. Materials which burn quickly not only afford little smoke, but they are likely to cause upward currents of air which may be injurious. The actual heat of the fire counts for nothing except in the immediate vicinity. Compounds which contain much tar are usually efficient. Of home resources, damp straw or hay, loose manure, prunings of trees, and other litter are among the best. It is essential that the piles be comparatively small and rather numerous. On level lands it is best to have these piles on all four sides of the area at a distance apart of not more than 10 to 30 feet. On somewhat steep slopes the piles may be placed on the upper side, since there usually is a slow current of air moving down the hillside which will carry the smoke over the plantation. The piles should be as wet as possible and yet burn. Usually Frost occurs in the latter part of the night. It is important, therefore, that the smudges be kept up all night if full protection is secured. It is best for a man to sit up and devote himself to the business. Brush piles made of dry trimmings are inefficient for Frost protection. Moist litter of some kind which burns very slowly should be mixed with them. Of late years various preparations of petroleum and tar have been perfected for the making of smudges, and when one has large areas to protect, these are the most efficient and economical materials to use.

In small areas, Frost may be prevented by sprinkling the plantation with water at nightfall. Any device which keeps the air in motion will also tend to prevent Frost; but such devices are impracticable except on a very small scale. In cranberry bogs Frost may be prevented by completely flooding the plantation.

Frosted plants may be recuperated by keeping them cool and rather dark for a day or two and syringing the tops with cold water. Do not let the sun strike them while they are frozen. Extract the Frost very gradually.

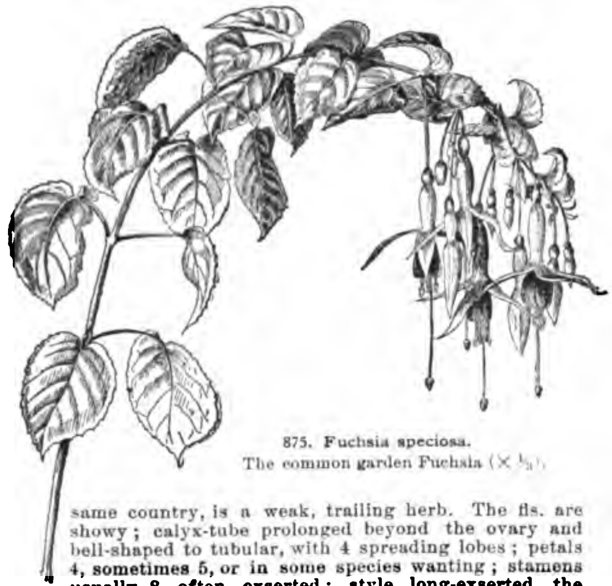
Farmer's Bulletin 34, of U. S. Dept. Agric., has 24 pages devoted to Frost.

L. H. B.

FROSTWEED. *Helianthemum Canadense.*

FRUIT-GROWING. Treated under *Pomology.*

FÙCHSIA (Leonard Fuchs, 1501–1565, German professor of medicine, and a botanical author). *Onagràceæ.* Sixty or 70 species, the greater part in tropical America, but three or four in New Zealand. They are very variable in character. The common Fuchsias are known to us as small herbs, but some of them are shrubs in their native countries. *F. excorticata,* of New Zealand, is a tree 30–40 ft. high, whereas *F. procumbens,* of the same country, is a weak, trailing herb. The fls. are showy; calyx-tube prolonged beyond the ovary and bell-shaped to tubular, with 4 spreading lobes; petals 4, sometimes 5, or in some species wanting; stamens usually 8, often exserted; style long-exserted, the stigma prominent: fr. (seldom seen under glass) a 4-loculed soft berry. Of the many species, less than half a dozen have entered largely into garden forms. The common garden kinds have come mostly from *F. Magellanica.* This species was introduced into Great Britain from Chile in 1788, or about that time. It is variable in a wild state as well as in cultivation, and plants subsequently introduced from South America were so distinct as to be regarded for a time as distinct species. Even at the present day some of the forms of *F. Magellanica* are commonly spoken of as species, so much do they differ from the type. As early as 1848, 541 species and varieties—mostly mere garden forms—were known and named (Porcher, "La Fuchsia, son Histoire et sa Culture"). The Fuchsia reached the height of its popularity about the middle of this century. At the present time it is prized mostly for window gardening and conservatory decoration. The garden forms of the present day are with difficulty referred to specific types. The long-tubed or so-called speciosa forms are probably hybrids of *F. Magellanica* and *F. fulgens* (Figs. 875, 876). Others are evidently direct varieties from the stem types. There are many full double forms. For the history and the garden botany of the Fuchsia, see Hemsley in the Garden 9:284 and 11:70; also Watson, the Garden 55:74.


875. Fuchsia speciosa.
The common garden Fuchsia (× ⅓).

Fuchsias are amongst the easiest of house plants to grow. The essential points are to have vigorous young plants and not to overpot; the plants bloom better if the roots are somewhat confined from the time that the plant reaches the required size. Any garden soil is suitable. Give the temperature of an ordinary living room, or that required for geraniums. Fuchsias grow readily from seeds, when these are obtainable, and blooming plants should be secured in less than a year. They are commonly grown from slips, or cuttings, of the nearly matured growing wood. Make the cuttings of one or two joints—preferably two,—allow two leaves to remain, but snip them in two to check loss from evaporation, and insert half their length in sand or washed gravel. In four or five months blooming plants should be obtained. For fall bloom, make cuttings in spring. For spring bloom, take cuttings in early fall or late summer. After flowering, the plants may be kept cool and comparatively dry if they are to be bloomed again; but it is usually more satisfactory to start a new lot each year from cuttings. However, one or two old and large specimen plants, in tubs or large pots, may be a desirable addition to the conservatory. Old plants may be cut back severely, and the young growth which is thrown out will give profuse bloom. Screen from full sunlight, keep the atmosphere moist, syringe if insects become troublesome, and give a rich soil. Most of the Magellanica types may be left in the open in the South if protected with mulch. There are Fuchsia hedges in S. Ireland and parts of England belonging to this type. L. H. B.

One of the great merits of the Fuchsia is that all of the strong and robust-growing types make excellent outdoor decorative plants in summer, and are especially adapted for shady and half shady places where few other plants will answer. This is particularly true of plants which have been kept over winter and have been trained into large bush plants or standards. After the first year, they make fine specimens, and they can be kept and used in this manner and for these purposes for many years. They can be stored in a cool greenhouse, light cellar or any other cool, out-of-the-way place, where hydrangeas, oleanders and such stock is wintered, leaving them in their pot-bound, semi-dormant state all winter, giving just enough moisture to keep them alive. The latter part of March or the beginning of April in the North, the plants can be started into growth, and as soon as root action begins they can be repotted or retubbed, using rich, open loam, with plenty of good drainage, and can remain in those pots or tubs for another year. When in bud or bloom, frequent application of liquid manure is very beneficial. Fuchsias are great feeders. They flower best when plunged with their pots or tubs in the ground outdoors, and can be left out until very late in the season, as they are nearly semi-hardy, and stand a little frost without serious injury. Cult. by H. A. SIEBRECHT.

Various Latin names of horticultural forms occur in the trade, but the following represent all the important botanical types in cultivation in this country:

alba, 6.
arborescens, 7.
coccinea, 1, 3.
conica, 1.
corallina, 1.
corymbiflora, 6.
decussata, 1.
discolor, 1.
elegans, 1.
Exoniensis, 1.
fulgens, 4.
globosa, 1.
gracilis, 1.
hybrida, 2.
Lowei, 1.
macrostemma, 1.
Magellanica, 1.
procumbens, 8.
pumila, 4.
Riccartoni, 1.
speciosa, 2.
syringæfolia, 7.
tenella, 1.
triphylla, 5.

A. *Fls. drooping.*

B. *Calyx-tube mostly shorter than the lobes (or in F. speciosa sometimes as long again): petals obovate and retuse, convolute in the bud.*—LADIES' EAR-DROPS.

1. **Magellánica,** Lam. (*F. macrostémma,* Ruiz & Pav. *F. coccínea,* Curtis, not Aiton). Calyx tube little longer than the ovary, oblong or short-cylindrical: petals normally blue, and shorter than the red and oblong-lanceolate calyx lobes; stamens long-exserted: lvs. opposite or in 3's, lance-ovate, very short-petioled, dentate. Peru and S. to Terre del Fuego. B.M.97. The leading types are as follows:

Var. **globòsa** (*F. globòsa,* Lindl.). Fls. small and short, the bud nearly globular and the tips of the sepals cohering even after the flower begins to burst; calyx tube very short. A profuse bloomer, and a common type amongst old-fashioned Fuchsias. Probably of garden origin. B.R. 18:1556. Gn. 55, p. 75.

Var. **cónica** (*F. cónica,* Lindl.). Small-fld., the bud conical-oblong; calyx tube nearly as long as the lobes; petals nearly equal to the calyx lobes. Raised from seeds brought from Chile. B.R. 13:1062.

Var. **díscolor** (*F. díscolor,* Lindl. *F. Lòwei,* Hort.). Dwarf and hardy: fls. small, with slender, short tube and wide-spreading, rather narrow calyx lobes, which are somewhat longer than the tube: branches deep purple: lvs. undulate-toothed. Falkland Isl. B.R. 21:1805.

Var. **grácilis** (*F. grácilis*, Lindl. *F. decussàta*, Grah.). Very slender and graceful, the fls. drooping on very long pedicels: tube slender, nearly as long as the narrow, spreading lobes: lvs. narrow, strong-toothed. Chile. B. R. 10: 847; 13:1052. B. M. 2507. Gn. 55, p. 74. Mn. 2, p. 186.—Possibly a distinct species.

With *F. Magellanica* may be classed *F. corallina*, Hort., *F. Exoniénsis*, Hort. (G.C. II. 20:565), *F. élegans*, Paxt., *F. Riccartòni*, Hort., *F. tenélla*, Hort., and others. Some of these are probably hybrids with *F. Magellanica*.

The short-flowered Fuchsias are less popular than formerly, but many varieties are now in cult. Of this set the Storm King is a representative.

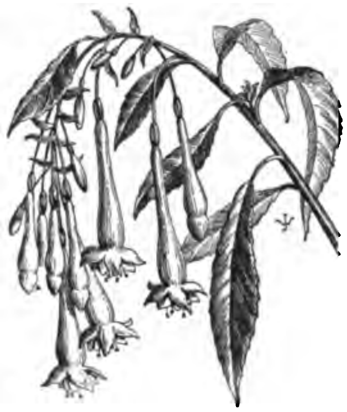
2. **speciòsa**, Hort. (*F. hỳbrida*, Hort.). Figs. 875, 876. The greater part of present-day garden Fuchsias are of the long-tubed type shown in the illustrations. These are probably hybrid derivatives of *F. Magellanica* and *F. fulgens*. Amongst the named sorts every gradation will be found, from the short-tubed Storm King to the Earl of Beaconsfield with fls. 3 in. long.

3. **coccínea**, Ait. Not known to be cult. in America, and inserted here for the purpose of clearing up the synonymy of *F. coccinea*. This species appears to have been introduced before *F. Magellanica*, and it was named *F. coccinea* by Aiton. *F. Magellanica*, however, "usurped its name and spread it to every garden in the kingdom, whilst the true plant lingered in botanic gardens, lastly surviving (greatly to the credit of the Baxters, father and son) in that of Oxford alone." The species was lost from its introduction in 1788 to its rediscovery. in an Oxford garden in 1867; meantime forms of *F. Magellanica* passed as *F. coccinea*. "*F. coccinea* is much more graceful than any of the varieties of *F. Magellanica*, flowers even more freely, and is readily distinguished by the almost sessile leaves with broad bases, and the hairy twigs and petioles; further, its foliage turns of a bright crimson when about to fall." —*J. D. Hooker*, B.M. 5740. Probably Brazilian.

876. Theresa, a form of Fuchsia speciosa (× ¾).

BB. *Calyx-tube thrice or more the length of the lobes: petals pointed, nearly or quite as long as the calyx lobes.*

4. **fúlgens**, Moç. & Sesse. Stem somewhat succulent, glabrous, often red-tinged: lvs. large and coarse, cordate ovate, soft, small-toothed: fls. in terminal, leafy clusters or racemes, the red long-tubular calyx-tube 2–3 in. long and very slender at the base; the calyx lobes short and pointed, greenish at the tip, not very widely spreading; petals deep scarlet, pointed; stamens only short exserted. Mex. B.M. 3801. B.R. 24:1. Gn. 55, p. 75. R.H. 1881:150 (var. *pumila*).— A brilliant plant, sometimes seen in choice conservatory collections. Evidently a parent of the *F. speciosa* tribes.



877. Fuchsia triphylla (× ⅓).

5. **triphỳlla**, Linn. Fig. 877. Low and bushy (18 in. high), pubescent: lvs. often in 3's, small, oblanceolate, petiolate, dentate, green above and purple pubescent beneath: fls. 1⅓ in. long, in terminal racemes, cinnabar-red, the long tube enlarging towards the top; petals very short; stamens 4, not exserted. St. Domingo, West Indies. B.M. 6795. Gn. 41:839. I.H. 43, p. 94.—Known in botanical collections and sparingly in the trade. The species has a most interesting history, for which see the citations made above. Upon this plant Plumier founded the genus Fuchsia in 1703, giving a rude drawing of it. Upon Plumier's description and picture Linnæus founded his *F. triphylla*. Plumier's figure is so unlike existing Fuchsias that there has been much speculation as to the plant which he meant to portray. No Fuchsia was known to have four stamens or to be native to the West Indies. In 1877 Hemsley wrote of it: "The figure, however, is so rude that nobody, I believe, has been able to identify it with any living or dried plant. Possibly it is not a Fuchsia at all in the sense of the present application of the name, for it is represented as having only four stamens." But in 1873 Thomas Hogg, of New York, secured seeds of a St. Domingo Fuchsia which turns out to be Plumier's original, thus bringing into cultivation a plant which had been unknown to science for 170 years. It came to the attention of botanists in 1882. For a discussion of further confusion in the history of this plant, see Hemsley, G.C. II. 18, p. 263–4.

6. **corymbiflòra**, Ruiz & Pav. Tall but weak grower, needing support when allowed to attain its full height, therefore excellent for pillars and rafters: lvs. large, ovate-oblong and tapering both ways, serrate, pubescent: fls. deep red, hanging in long brilliant corymbs; calyx tube 3–4 in. long and nearly uniformly cylindrical, the lobes lance-acuminate and becoming reflexed; petals deep red, lance-acuminate, about the length of the calyx lobes; stamens length of the petals. Peru. B.M. 4000. Gn. 11:58; 55:1203. F.J. 1841:161. Var. **álba**, Hort., has white or nearly white calyx-tube and lobes. F.S. 6:547. Gn. 55:1208—A very handsome plant, but not common.

AA. *Flowers erect.*

7. **arboréscens**, Sims (*F. syringæfòlia*, Carr.). A shrub: lvs. lance-oblong and entire, laurel-like: fls. pink-red, small, with a short or almost globular tube,

in an erect terminal naked lilac-like panicle; calyx lobes and petals about equal in length. Mex. B.M. 2620. —Little grown, but excellent for winter flowering.

8. **procúmbens,** Cunn. TRAILING FUCHSIA. TRAILING QUEEN. Trailing: lvs. alternate, small (⅓–½ in. across), cordate-ovate, long-stalked: fls. solitary and axillary, apetalous, the short calyx tube orange and the reflexing obtuse lobes dark purple, anthers blue: plant diœcious. N. Zeal. B.M. 6139.—A very interesting little plant, suitable for baskets.

Species which are not known to be in the Amer. trade are *F. amplidta*, Benth. Fls. large, scarlet, long-tubed, drooping. Colombia. B.M. 6839.—*F. bacillàris*, Lindl. Compact, with short-jointed branches: fls. very small, flaring-mouthed, rosy, drooping. Mex. B.R. 18:1480.—*F. cordifòlia*, Benth. Fls. 2 in. long, slender, drooping, hairy, red, on very long pedicels. Mex. B.R. 27:70.—*F. Dominidna*, Hort. Garden hybrid with long drooping red fls. of the speciosa type. F.S. 10:1004.—*F. macrántha*, Hook. Largest-fld. Fuchsia; 4–6 in. long, pink-red, in large, drooping clusters. Colombia, Peru. B.M. 4233.—*F. microphýlla*, HBK. Dwarf, small-lvd., with deep red, small axillary, drooping fls.: pretty. Mex. B.R. 15:1200.—*F. serratifòlia*, Ruiz & Pav. Fls. long-tubed, speciosa-like, on drooping pedicels from the axils of the whorled lvs., pink, with greenish tinge: handsome. Peru. B.M. 4174.—*F. simplicicaùlis*, Ruiz & Pav. Lvs. usually in 3's, entire: fls. crimson, long and slender-tubed, in drooping clusters: resembles F. corymbifera. Peru. B.M. 5096.—*F. spléndens*, Zucc. Shrubby, hairy: fls. drooping, with a short, thick red tube, short, greenish lobes and petals, and long-exserted stamens. Mex. B.M. 4082.

L. H. B.

FULLER, ANDREW S., horticultural writer, was born in Utica, N.Y., on August 3, 1828, and died May 4, 1896, at his home at Ridgewood, Bergen county, N. J. Fig. 878. When quite young he removed with his parents to Barre, N.Y., where his father tilled a small farm. At the age of 18 he went to Milwaukee, Wis., where he worked at the carpenter's trade, and became particularly skilful in the construction of greenhouses, and built a small one for himself on a city lot. Here he brought together a varied collection of plants, the care of which founded the nucleus of his later attainments and renown as a horticulturist. While he lived in Milwaukee he married Miss Jennie Crippen, who survives him. They never had any children. In 1855 they moved to Flushing, L. I., N.Y., when William R. Prince offered Mr. Fuller the management of his greenhouses. But his ambition did not allow him to remain long in the employ of others, and in 1857 he removed to Brooklyn, N.Y., and engaged in grape and small fruit culture, which were then in their infancy. Here he gave particular attention to the improvement of the strawberry by cross-fertilization and selection of the best of the many thousands of seedlings raised by him. The most famous of these were Brooklyn Scarlet, Monitor and Colonel Ellsworth, the first of which was generally recognized as the highest-flavored strawberry in existence at the time, although too soft for market. The entire stock of 300,000 plants was purchased by the "New York Tribune," which sent them out as premiums to its subscribers, in consequence of which they have been widely known as the "Tribune strawberries." It was during this period that Fuller wrote his first book, the "Strawberry Culturist." In this work he brought together and systematized all that was known about the subject at the time, combined with the results of his own practical experience. The principles underlying scientific strawberry culture, as well as the practical hints and directions for carrying on the work in the garden and field, are given in so thorough and admirable a manner that even now, after 40 years since they were written, it would be difficult to improve upon them. Realizing the necessity of having more ground for experimentation, and in order to escape the noise and turmoil of the city, he bought a large piece of land near Ridgewood, N. J. This, when he moved on it, early in the sixties, was little more than a barren waste, but under his constant care it was not long before it developed into one of the most charming homes and interesting and instructive garden spots in the country. Almost every species and variety of ornamental trees and shrubs hardy in the locality were represented, and his collection of small fruits was the most complete in the country. These furnished him unequaled means and material for observation, study and identification, the results and accounts of which he made known in the clear, concise, convincing style for which his writings have become famous. A. S. Fuller was an indefatigable worker, physically as well as mentally. Immediately after the publication of the "Strawberry Culturist," he commenced working on the "Grape Culturist." This was followed by the "Small Fruit Culturist," "Practical Forestry," "Propagation of Plants," and the "Nut Culturist." The last of them he was fond of calling his "monument," as he did not intend to write another book, and so fate decided that it should be. He died a few days after he had finished his manuscript, and never saw the completed book, of which he was perhaps more proud than of any other of his works, yet in the history of horticultural literature his "Small Fruit Culturist" will, no doubt, occupy the foremost rank. It was more instrumental in the development and building up of the great industry to which it is devoted than any other book written before or after, and in any land. It was translated into German and published in Weimar in 1868. His books contain but a small part of his writings. His editorial and other contributions to the "American Agriculturist," to "The Rural New-Yorker," of which he was part owner for a time, the "New York Sun," of which he was agricultural editor for 26 years, "American Gardening" and other periodicals would fill hundreds of volumes. He was also editor of the "Record of Horticulture," 1866–1867. While Mr. Fuller was principally known as a horticulturist, there was hardly a branch of natural science to which he had not devoted more or less attention. His entomological collection, especially that of coleoptera, was one of the most complete in the country; his mineralogical and archeological collections contained many rare specimens, and his horticultural library was one of the most complete in the United States. Personally, Mr. Fuller was a charming man, liberal and hospitable almost to a fault. He was a man of striking personality, of decided character and opinion, and an implacable foe to sham and deceit. In whatever he undertook he was always a leader, never a follower; he was always on the lookout for new grounds to traverse, and nothing made him happier than when a new problem presented itself for solution, but as soon as it was solved his interest in it ceased. During the later years of his life, although in good health, Mr. Fuller left his place but seldom, but in his earlier years he traveled considerably, and took an active and leading part in the meetings of the American Pomological Society, the American Institute Farmers' Club, the Fruit-Growers' Club, and many kindred societies, of which he was an active or honorary member.

F. M. HEXAMER.

878. Andrew S. Fuller.

FUMÀRIA (*fumus*, smoke). This genus includes the common Fumitory, *F. officinalis*, formerly held in great repute for various ailments, but now practically banished from medical practice. Seeds are still rarely sold to those who have faith in old physic gardens. The plant is fully described in our commonest botanies, and has a large literature, which is especially interesting to those who delight in herbals. As an ornamental plant, it is far surpassed by Adlumia. The genus gives name to the family *Fumariaceæ*.

FUMITORY. *Fumaria officinalis.*

FUNGICIDE (see *Spraying*) is a material used to destroy fungi or to prohibit their growth. The leading Fungicides are materials which contain sulfur or copper. Bordeaux mixture is the chief Fungicide in use at the present time. It is a mixture of blue vitriol (sulfate of copper) and lime, in water. The usual formula is

Copper sulfate	6 lbs.
Lime	4 lbs.
Water	35–50 gals.

The copper sulfate is dissolved in the water, and milk of lime is added. In spraying large areas, it is better to prepare stock solutions for the Bordeaux mixture rather than to make each batch in the quantities called for by the formula. The sulfate of copper may be put into solution and kept in this condition indefinitely, ready for use. A simple method is to dissolve 40 or 50 pounds of sulfate in as many gallons of water, pulverizing the material and hanging it in a coffee-sack in the top of the barrel. A gallon of water, therefore, means a pound of sulfate. The lime may also be slaked and kept in readiness for use. Slake it into the creamy condition familiar to masons, cover lightly with water, and then close the box or vessel to prevent the water from evaporating. When making the Bordeaux mixture, pour the requisite quantity of the stock solution of sulfate of copper into the barrel, and then fill the barrel half full of water. Now add the lime (which should be diluted with water), stir, and add enough water to satisfy the formula. In order to test whether the sulfate has been neutralized by the lime, a little ferrocyanide of potassium may be applied to the mixture. Place a spoonful of the Bordeaux mixture in a saucer or plate, and add a drop of the ferrocyanide. If a red color appears, the mixture needs more lime. If the test solution is added directly to a tank or barrel of the mixture, the color reaction is likely to be lost in the mass. An excess of lime insures the safety of the mixture.

The Bordeaux mixture is used for many parasitic fungous diseases. It is not only inimical to fungi, but it adheres to foliage and stems for a long time. Best results are secured when it is applied before the fungus has become established. Bordeaux mixture is usually more satisfactory when it has not stood long.

The sulfate of copper is the active Fungicidal ingredient of the Bordeaux mixture, but if applied alone, in water, it is very caustic to foliage, and it does not adhere long. For the treatment of dormant trees and shrubs it may be very useful, since it can be used strong, and is thereby very destructive of fungi. For dormant wood it is often used 1 lb. to 10–15 gallons of water.

The greatest competitor of Bordeaux mixture is a mixture made by dissolving carbonate of copper in ammonia and then diluting the solution with water. It is sometimes used on ornamental plants and nearly ripe fruits, since the Bordeaux mixture renders them untidy. One ounce of copper carbonate will be dissolved by 1 pint or less of very strong ammonia. This concentrated liquid can be kept indefinitely. When to be used, dilute with 8–10 gallons of water.

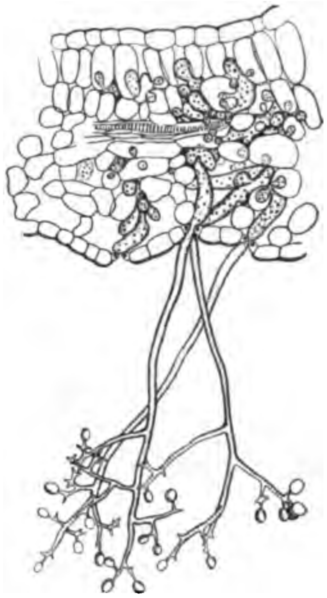
Dry sulfur is a Fungicide. It is sometimes dusted on plants in glasshouses for surface mildews, and it is much used in California vineyards. It is oftenest used as a vapor in houses. If smeared on the heating pipes, the fumes will give a perceptible odor in the house, and will prevent the mildews of roses, cucumbers, and other plants. The sulfur must not be burned, for the fumes of burning sulfur are fatal to plants.

L. H. B.

FUNGUS (plural, *Fungi;* adjective, *fungous*). The class Fungi includes all those plants which are popularly known as mushrooms or toadstools, puffballs, rusts, smut, molds and mildews. These, however, form but a small part of the total number. There are many others which are inconspicuous, like the yeasts, or which are of no special economic importance and hence have escaped popular notice. All the parts of a fungous plant are seldom seen. That part which is usually exposed to view, and which is popularly designated as a Fungus, is merely the fertile or fruit-bearing part of the plant. A mushroom is the fruit of a Fungus. The vegetative part, that which supplies and elaborates materials for the growth of the plant, and which, in a way, corresponds to the roots and leaves of higher plants, is hidden away in the ground, in decaying wood and other organic matter, or within the tissues of other living plants upon which the Fungus feeds.

Both the vegetative and the fruiting part of all Fungi, excepting some of the yeasts, are made up entirely of microscopic threads, which are very much branched and divided into elongated cells by crosswalls at irregular intervals. These threads are called hyphæ. The vegetative hyphæ considered collectively are spoken of as the mycelium or spawn of the Fungus in the same sense in which we speak of the roots of a tree.

In the lower Fungi, such as molds and most of the parasitic species, the mycelium is comparatively simple, consisting of much-branched threads which course through the nutrient material upon which they grow, or, in the case of parasitic Fungi, either among the cells, or, as mildews, on the surface of their hosts. At the fruiting time many threads grow out from the substratum to the light and air. These threads remain simple or become branched like the trunk of a tree, and finally bear spores at the ends of the threads or branches. Examples of these plants are the blue mold on jam, etc., the common bread mold, and nearly all the Fungi which form spots or a white coating on leaves. The mycelium of toadstools and other higher Fungi is of much greater extent and more highly developed than that of the molds. It is often seen as a cottony weft forming white patches on posts and boards exposed in damp, dark places. It can always be found on sticks and on decaying leaves in the woods. The white threads in fire-fanged manure are also mycelium. Perhaps the best known form of mycelium is the spawn in bricks, commercially known as "mushroom spawn." In nature the mycelium of these plants often forms strands as much as an eighth of an inch in thickness. It grows for varying periods of time, sometimes for years, in the ground, in decaying organic materials, or in fallen and standing trunks, etc., until it is ready to fruit.



879. A Fungus.

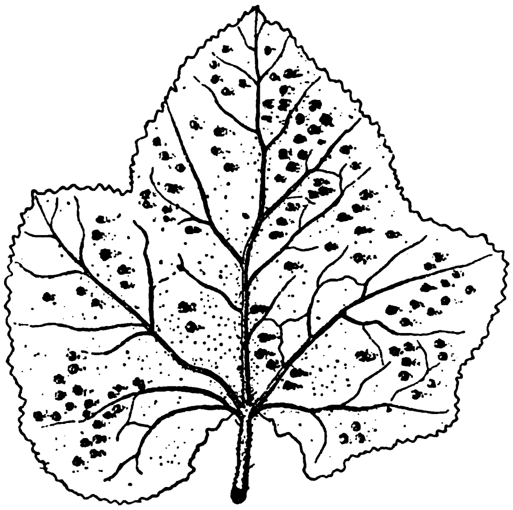
A mildew, showing the mycelium in the leaf tissue and the hanging spore-bearing threads. Much magnified.

The fruit of these plants is not formed from a single, erect thread, but of many hundreds of threads which appear above the substratum as a thick bundle or as a tuberculiform mass. The threads increase in length and send out many branches which become closely interwoven, gradually building up the fleshy umbrella-like bodies, or the hard shelving masses, which we know as toadstools, mushrooms, etc. The spores are borne on the lower, protected side of the fruit bodies on gills or spines, within honey-combed pores, or directly upon the smooth, lower surface.

All Fungi grow on living or dead organic matter. They have no chlorophyll, and hence cannot assimilate carbon from carbon di-oxid.

H. Hasselbring.

A Fungus is a plant of very low organization consisting of one or more cells multiplying its kind by cell division and by spores. It contains no green substance (chlorophyll), and grows either as a saprophyte upon non-living organic matter or derives its food directly from another living organism, and is then a true parasite. Fungi are very common, and range in size from the large hard-shell Fungus upon logs and the puff-ball and toadstool in the rich earth to the delicate moulds that infest bread and other foods, and the still more microscopic forms that produce fermentation, as yeast in dough and other species employed in making beer. Some of the toadstools are very richly tinted with red, yellow, brown and even blue, and a few are deadly poisonous, as the "death cup" and the "fly agaric," which grow upon the decaying organic matter in shaded places. Others are wholesome, and are grown as articles of food, the leading species of which is the mushroom, *Agaricus campestris*. More highly prized still is the truffle, which is produced under ground and hunted by hogs, which find them by their odor, and even muzzled hogs are trained to unearth them.



880. Colonies of the rust Fungus on the leaf of a hollyhock.

One of the parasitic species, ergot, infests the heads of rye, changing the grains into much enlarged horny purplish masses called "spurred rye" because of the resemblance of the fungous grains to a cock's spur. This is extremely poisonous, and when eaten by live stock with the hay or grass has been known to destroy whole herds. This Fungus furnishes one of the most valuable in the whole long list of drugs. Many other fungi grow in the heads of grain, the most conspicuous being the corn smut, which changes the whole ear possibly into a large mass of dark slime when wet, and brown dust when dry. This dust is the myriads of spores which the Fungus produces to secure its reproduction. In a similar manner other smuts destroy the oats, wheat and very many kinds of grasses and other plants.

The rusts are similar Fungi which thrive upon the juices of plants and produce patches of orange or yellow upon leaf or stem, the discolored portion being usually swollen and the skin more or less broken.

There is another group of Fungi known as the mildews, and these usually produce a fine whitish coating to the diseased part, due to the fine stalks that come from the surface of the plant and bear the spores.

Fungi love warmth and moisture for their greatest activity, and therefore they are more in evidence in midsummer when wet weather prevails than at other times. The spores are so small and light that they float in the air, and it is only when substances like canned goods have these spores excluded by first killing those present and preventing access of others, that they will keep unattacked,—that is, sweet and edible. Substances can be easily inoculated by introducing the germs, as mold into potatoes, rust into a tree, or yeast into dough. The number of kinds of Fungi is high among the thousands, and new species are being found each month, but they are so small that only specialists can understand the microscopic differences that separate one kind from another. Many Fungi have certain forms which are assumed in the cycle of life, and in this they resemble insects with their larval, pupal and imago stages. This polymorphic nature has made the study of the Fungi very puzzling. While a few of these plants are poisonous, and many destructive to life, the greatest majority are scavengers, reducing the waste products to simpler and harmless forms. We could not get on well without this minute and humble race of plants.

For further discussion, see *Diseases*.

Byron D. Halsted.

FÚNKIA (Ludwig P. Funke, 1755–1807, and H. C. Funk, 1771–1839, German naturalists). *Liliàceæ*. Day Lily. Plantain Lily. Five or six Japanese perennial herbs, producing attractive clumps of foliage and interesting blossoms. Fls. in terminal racemes or spikes, white or blue; perianth funnel-form, 6-parted and more or less irregular, the lobes not widely spreading; stamens 6, the filaments filiform, the anthers long-oblong and versatile: pod oblong and angled, many-seeded, splitting into 3 valves (Fig. 884); seeds flat and black, winged at the apex. Monogr. by Baker, Jour. Linn. Soc. 11:366. See also, Mottet, R.H. 1897, p. 114.

Funkias are hardy and of the easiest culture. Their dense stools or clumps of foliage are in place along walks or drives and in the angles against buildings. A continuous row along a walk gives a strong and pleasing character. Make the soil rich and deep. The clumps improve with age. The large-leaved kinds grow vigorously in moist, shady places. Of some varieties the lvs. are strikingly variegated. Bloom in summer. Foliage is killed by frost. Prop. by dividing the clumps; some species produce seeds freely, and seedlings can be grown readily if seed is sown as soon as ripe.

881. Colonies of a Fungus on a plum leaf.

The dead tissue sometimes falls out, leaving a shot-hole effect.

A. *Fls. white, ascending: fl.-bract very large, with a smaller one inside.*

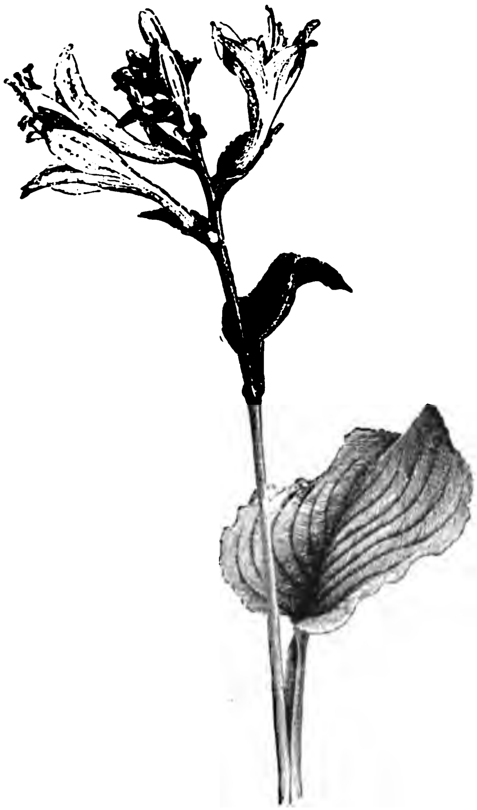
subcordàta, Spreng. (*F. álba*, Sweet. *F. liliiflòra*, Hort. *F. Japónica*, Hort., at least of some. *F. macrántha*, Hort. *F. cordàta*, Hort., not Sieb.). Fig. 882. Lvs. large, broadly cordate-ovate, with a short, sharp point, green, many-ribbed: fls. large, 4–6 in. long, with an open bell-shaped perianth, waxy white, the base of the tube surrounded by a broad bract: spike short, the bracts very prominent.—The commonest species in old yards, and an excellent plant. The fls. have an orange-like odor. Clumps of foliage grow 12–20 in. high. B.M. 1433, as *Hemerocallis Japonica.*

Var. **grandiflòra,** Hort. (*F. grandiflòra*, Sieb. & Zucc.), has very long and large fls. G.C. III. 4:153. *F. macrántha*, Hort., probably belongs here.

AA. *Fls. blue or lilac, more or less inclined or nodding: bract 1.*

B. *Lvs. glaucous.*

Sieboldiàna, Hook. (*F. Sièboldii*, Lindl. *F. glaùca*, Hort. *F. Sinénsis*, Sieb. *F. cucullàta*, Hort. *F. glaucéscens*, Hort. *F. cordàta*, Sieb.). Differs from the last in the metallic blue color of the less cordate lvs., in the inclined bluish or pale-tinged, more slender-tubed and smaller fls. (which do not rise above the foliage), and in having only one small bract at the base of the fl. B.M. 3663. B.R. 25:50. L.B.C. 19:1869, as *Hemerocallis Sieboldtiana.* There is a form with the body of the leaf yellowish white and the edge green. L. 69.—Lf. blade and petiole each 1 ft. long, the foliage therefore overtopping the fls. The plant usually cult. as *F. Sieboldiana* is probably *F. Fortunei.*



882. Funkia subcordata (× 1-5).

Fórtunei, Baker. Differs from *F. Sieboldiana* in having smaller lvs. and the racemes much overtopping the foliage, as in other Funkias. Petiole 2–3 in. long; blade cordate-ovate, 4–5 in. long: raceme ½ ft. long on a stem or scape 1 ft. long: fls. pale lilac, funnel-shape, 1½ in. long, the segments lanceolate and ascending and half as long as the tube.—Excellent. Generally cult. as *F. Sieboldiana*, and many of the pictures of that name probably belong here, as, apparently, Gn. 38, p.79; A.G. 11:157; A.F. 6:322. It is probable that the garden synonyms cited under *F. Sieboldiana* are usually applied to plants of *F. Fortunei.*

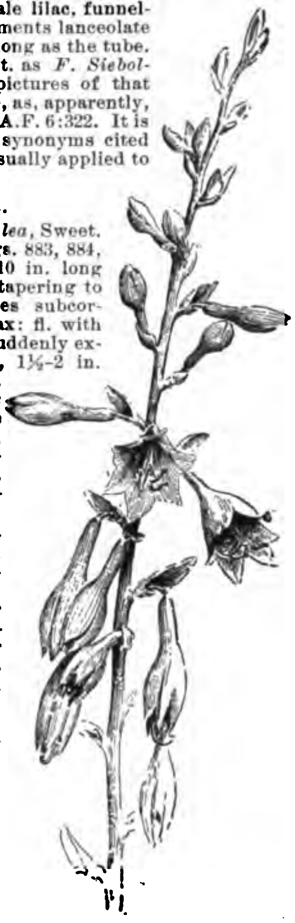
BB. *Leaves green.*

ovàta, Spreng. (*F. cærùlea*, Sweet. *F. lanceolàta*, Sieb.). Figs. 883, 884, 885. Lvs. broad-ovate, 5–10 in. long and half as wide, usually tapering to the petiole, but sometimes subcordate: raceme long and lax: fl. with a short, slender tube and suddenly expanding into a bell-shape, 1½–2 in. long, nodding, deep blue. B.M. 894, as *Hemerocallis cærulea.* Mn. 1:73.—The commonest blue-fld. species; usually known as *F. cærulea. F. marginàta*, Sieb., is a form with white-bordered lvs.

lancifòlia, Spreng. (*F. Japónica*, Hort., of some). Lvs. lanceolate to narrowly ovate-lanceolate, the blade 6 in. or less long and 2 in. or less wide: raceme lax, 6–10-fld., on a tall, slender stem: fls. 1½ in. or less long, the tube slender and gradually enlarging upward, pale lilac. Var. **álbo-marginàta,** Hort. (*F. álbo-marginàta*, Hook., B.M. 3657) has the lvs. edged white. Var. **undulàta** (*F. undulàta*, Otto & Dietr.) is a form with undulate white-margined lvs.—Graceful. Fls. smaller than those of *F. ovata.*

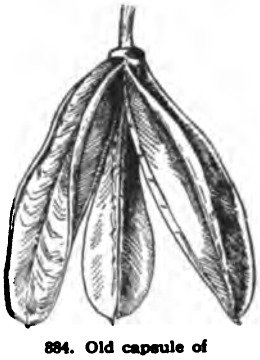
F. aùrea, Hort., variegated forms of various species.—*F. elàta*, Hort., "bears tall scapes of pale blue fls."—*F. gigantèa*, Hort., has "long spikes of blue fls."—*F. marginàta*, Hort.=F. lancifolia, var. alba-marginata.—*F. tardiflòra*, Hort.=?—*F. univittàta*, Hort.=F. lancifolia var.—*F. variegàta*, Hort.=variegated forms of various species, usually of F. ovata or F. lancifolia.—*F. víridis-marginàta*, Hort., is probably a form of F. ovata.

L. H. B.



883. Funkia ovata (× 1-5).

FURCRÆA (Ant. François de Fourcroy, 1755–1809, chemist). Syn., *Fourcroya, Fourcræa, Furcroya, Furcræa. Amaryllidàceæ.* About 17 species of succulent desert plants from tropical America, particularly Mexico, some with spiny foliage like Agave, others with minutely toothed margins like Beschorneria. They occasionally bear immense loose panicles of greenish white fls., suggesting those of *Yucca filamentosa*, which are known to every plant-lover of the North. The perianth of Furcræa is whitish and wheel-shaped; in Agave greenish yellow, funnel-shaped. The filaments in Furcræa have a cushion-like swelling at the base, which is absent from Agave. Furcræa is cultivated much in the same way as Agave,



884. Old capsule of Funkia ovata. Nat. size.

except that the Furcræas are given more heat and water. *F. gigantea* has a very pretty variegated form, which makes a useful pot-plant.

As a rule, Furcræas bear fruit not more than once, and then die without producing suckers. However, they produce while in flower an immense number of bulbels, which may be used for propagation. It is impossible to say at what size or age the plants will bloom. Grown in pots, they may take a century. On the other hand, plants from bulbels have been known to flower at 3 years.

885. Funkia ovata. (See page 619.)

A. *Texture of lvs. firm: spines usually present, deltoid: no minute teeth on margin. (Furcræa proper.)*

B. *Trunk 3–4 ft. long: spines absent.*

gigantèa, Vent. Lvs. 4–6 ft. long, 4–6 in. broad at middle, 2½–3 in. above base, usually without marginal spines, rarely with a few near the base: peduncle 20–40 ft. long: odor of fls. strong. Trop. Amer. Naturalized in Mauritius, Madagascar, India. B.M. 2250. G.C. III. 23:227. R.H. 1857, pp. 206, 207. Var. **variegàta**, Hort., has variegated lvs.

BB. *Trunk none or short: spines present.*

C. *Length of lvs. 12 ft. or more.*

altissima, Todaro. A recent and little known species named at Palermo, Italy. Franceschi writes that it has hardly any trunk: lvs. bright green, with very few spines, 12 ft. long or more, erect, not drooping. It is tenderer than the other kinds.

CC. *Length of lvs. 5–6 ft.*

élegans, Todaro. Lvs. 4–5 in. broad at middle, 3 in. above base, rough on the back; prickles large: peduncle 20–25 ft. long. Mex.

CCC. *Length of lvs. 2–3 ft.*

D. *Prickles usually large-sized.*

E. *Panicle reaching 10–12 ft.; branches slightly compound.*

Cubénsis, Haw. Lvs. 3–4 in. broad above middle, 1⅛ in. above base, the tip convolute; prickles large, distant, hooked: peduncle 5–6 ft. long. Odor of fls. faint. This and *F. gigantea* are widely spread in trop. Amer. and often cult. in the Old World. They are the oldest in cult. All the rest are rare. Var. **inérmis**, Baker, is spineless. B.M. 6543. *F. Líndeni*, Jacobi, has variegated lvs. I.H. 21:186.

EE. *Panicle reaching 30 ft.; branches copiously compound.*

tuberòsa, Ait. Lvs. a trifle longer and narrower than in *F. Cubensis*, 2–3 in. broad: fls. sweet scented. Int. by Franceschi, 1900.

DD. *Prickles middle-sized.*

pubéscens, Todaro. Baker does not say that the lvs. are not convolute at the tip, nor does he distinguish the lvs. from those of *F. Cubensis*, except in the smaller-sized prickles. It is presumably the only species in Furcræa proper with a pubescent ovary. Peduncle scarcely longer than the lvs.: panicle 5 times as long as the peduncle; branches copiously compound. Trop. Amer. B.M. 7250.

AA. *Texture of lvs. flexible and wavy: spines absent: minute teeth on margin. (Subgenus Ræzlia.)*

B. *Trunk 5–6 ft. high: lvs. glaucous.*

Bedinghaúsii, K. Koch (*F. Roézlii*, André. *Yúcca Parmentièri*, Roezl. *Ræzlia règia*, Hort.). Lvs. 3–4 ft. long, 3–4 in. broad at middle, 1 in. above base, permanently glaucous on both sides, very rough on the back: inflor. 15–20 ft. high. Mex. R.B. 1863, p. 327; 1883, p. 133 (full history). R.H. 1887, p. 353; 1895, pp. 468, 469. B.M. 7170. Gn. 52, p. 197. G.C. III. 9:489.

BB. *Trunk finally 40–50 ft. high: lvs. not glaucous.*

longæva, Karw. & Zucc. Lvs. 4–5 ft. long, 4–5 in. broad, narrowed to 2 in. above base, the roughness on the back only on the keel: inflorescence 40 ft. long. Mex. B.M. 5519. G.C. II. 16:653.

F. FRANCESCHI, G. W. OLIVER and W. M.

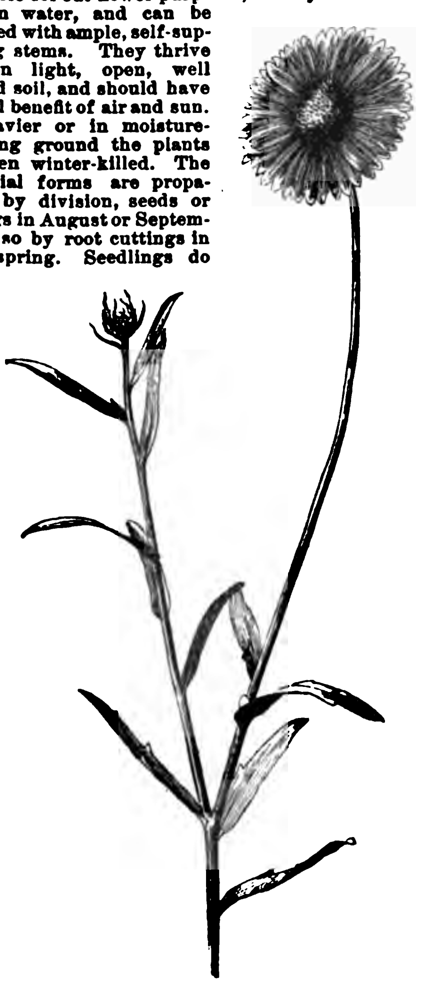
FURZE. *Ulex*, particularly *U. Europæus*.

G

GAILLÁRDIA (personal name). *Compósitæ.* About a dozen American herbs (largely of Atlantic N. Amer.), with alternate, simple, more or less toothed, punctate lvs. and solitary yellow or red, showy heads: ray fls. usually neutral, often with 2 or more colors or shades; disk fls. mostly purple, the styles with slender hispid branches; involucre with two or more rows of leafy scales. Gaillardias are popular and worthy garden plants. There are two types,—the annual forms, which are derived from *G. pulchella* and *G. amblyodon*, chiefly from the former; and the perennials, which issue from *G. aristata*. The species are variable and confusing.

Amongst hardy perennial plants, Gaillardias are conspicuous for profusion and duration of flowers. A constant succession is produced all summer until very late in autumn. They produce a most gorgeous effect in beds or borders. Moreover, they are highly recommendable for cut-flower purposes, as they last for a long time in water, and can be gathered with ample, self-supporting stems. They thrive best in light, open, well drained soil, and should have the full benefit of air and sun. In heavier or in moisture-retaining ground the plants are often winter-killed. The perennial forms are propagated by division, seeds or cuttings in August or September; also by root cuttings in early spring. Seedlings do not reproduce the parent; therefore, if we are in possession of an extra good variety, we must resort to the other modes of propagation, though for general purposes we may rely on seed sowing, as this involves less labor, but the cuttings make the better plants. *G. grandiflora* and its many varieties are garden forms of *G. aristata*. Great improvements have been introduced in late years. Some of these are highly colored and of extraordinarily large size, many of the flowers measuring 4 to 5 in. across, as in the variety named Jas. Kelway. Another class has quilled florets (*G. fistulosa*), of which Buffalo Bill is an excellent sample—a large, pure yellow, with maroon disk. Vivian Grey is also a remarkable and most distinct variety, with clear yellow, fringed rays and disk of the same color.

Cult. by J. B. Keller.



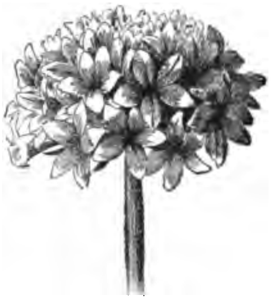
886. Gaillardia pulchella, var. picta (× 2-5).

A. *Annual Gaillardias: fls. normally mostly red.*

amblyòdon, Gay. One–2 ft., erect, leafy, hirsute: lvs. oblong or spatulate, sessile and auriculate, entire or nearly so: lobes (or teeth) of the disk corollas short and obtuse: rays numerous, brown-red or maroon throughout their length. Tex. F.S. 21:2149.—Somewhat cult. amongst garden annuals, and worthy.

pulchélla, Foug. Erect, branching, 12–20 in., soft-pubescent: lvs. oblong, lanceolate or spatulate, rather soft, nearly sessile, either entire or the lower ones lyrate-pinnatifid: lobes of disk fls. acute or awned: heads 2 in. across, the flat rays yellow at top and rose-purple at base. Ark. and La. to Ariz. B.M. 1602, 3551 as *G. bicolor.*

Var. **picta,** Gray (*G. picta*, Hort.). Fig. 886. The common garden form under cult., having larger heads and of various colors. B.M. 3368. R.H. 1852:20. In one form (*G. fistulosa, G. tubulosa, G. Lorenziana,* Hort.), the ray florets and sometimes the disk florets are enlarged and tubular. Fig. 887. R. H. 1881, p. 377; 1885:156.



887. Gaillardia pulchella. The form known as *G. Lorenziana* (× ⅓).

AA. *Perennial Gaillardias: fls. normally yellow.*

aristàta, Pursh (*G. grandiflòra, G. lùtea, G. máxima,* and *G. perénnis,* Hort.). Erect, 2–3 ft.: lvs. rather thick, lanceolate or oblong, sometimes spatulate, varying from entire to sinuate pinnatifid: lobes of disk corollas acute or awned: heads 3–4 in. across, the flat rays yellow, or in cult. varying to red (particularly at the base). Plains W. B.M. 2940. B.R. 14:1186. Gng. 2:345. —This is the common perennial Gaillardia of gardens (cult. under many names). Blooms the first year from seed. From *G. pulchella* it is distinguished by taller growth, firmer lvs., yellower heads, and less attenuate lobes of the disk fls.; but it is practically impossible to distinguish the two, except that one is annual and the other perennial.

L. H. B.

GALÁCTIA (Greek, *gala*, milk; some kinds said to have a milky juice). *Leguminòsæ.* Perhaps 50 species of prostrate or twining perennial herbs or erect shrubs, widely scattered. They are of the smallest hort. value, and are chiefly distinguished by the calyx lobes, 4, entire, acute: fls. in racemes, or the lower ones clustered in the axils: pods linear. Two kinds, once adv. by E. Gillett.

A. *Leaflets 3.*

glabélla, Mich. Prostrate, glabrous: stems matted, usually branching, 1–2 ft. long: lfts. elliptic, often notched at tip: fls. 4–10, reddish purple: pods slightly pubescent. Dry, sandy soil. N.Y. to Fla. B.B. 2:335.

AA. *Leaflets 7–9.*

Élliottii, Nutt. Lfts. elliptic-oblong, notched, pubescent beneath: fls. white, tinged red: pod silky. Dry soil. S. C. to Fla.

GALÁNTHUS (Greek, *milk flower*). *Amaryllidàceæ.* SNOWDROP. The flowers of Snowdrops (*G. nivalis*, Fig. 888) are amongst the smallest and daintiest of our common hardy cultivated spring-blooming bulbs. Much sentiment attaches to them, and in many an old-fashioned garden they are the earliest flowers of the new year. They often bloom in early March, before all the snow has gone. Their pendulous white flowers, with the "heart-shaped seal of green" dear to Rossetti, hold a unique place in the affections of lovers of gardens. Snowdrops are amongst the very few flowers in nature in which the green color is decidedly attractive to our senses. At first sight the fls. seem to have 3 large white petals, inclosing a green and white tube with 6 tips, but a second glance shows that the parts that function as petals are the outer segments of the perianth, while the 3 inner ones, with their 2-lobed tips, are not grown together, but overlap slightly, forming a rather crude but stiffish tube. It would be interesting to know whether the green marks have any relation to calyx tips. Each plant has a globose coated bulb, 2–3 lvs., grows 6–9 in. high, and bears usually only 1 flower, which emerges from a spathe. Behind the perianth is a globose green body, which is the ovary.

In a congenial spot, moist, cool and shady, the plants increase satisfactorily, and sometimes, without any care whatever, form a bed from which literally thousands of flowers may be picked at what is, perhaps, the most desolate and wearisome moment of the year. (For a fine picture of Galanthus, naturalized in the grass, see G.M. 34:184.) The leaves are linear and channeled, and in dark, shining masses make a rich, quiet effect. They come out with the fls., attain their full growth later, and commonly die down in midsummer or fall. A fine large bed of Snowdrops is more to be desired than many novelties, rarities, or any individual plants of indifferent health and vigor. The bulbs are cheap, and should be ordered in liberal quantities. In purity, modesty and simplicity, Snowdrops have perhaps no peers among hardy spring-blooming bulbs other than squills, grape hyacinths, and the glory-of-the-snow (Chionodoxa). Crocuses are more cheerful and more brilliant plants, with larger and more variously colored flowers.

888. The Snowdrop—Galanthus nivalis.

An era of new interest in Snowdrops began about 1875, with the introduction of the "giant" kind (*G. Elwesii*, Fig. 889), but those who do not care for "large violets" will be likely to cling to the small Snowdrops. Nevertheless, *G. Elwesii* is very distinct, and should be the first choice if any large kinds are desired, and to secure the best forms the connoisseur should buy imported bulbs of its varieties. The only kinds known so far to possess a patch of green at the base of the inner segments are *G. Elwesii* and *Fosteri*. Considering that there are only 2 main types in this genus, *nivalis* and *Elwesii*, the profusion of Latin names (especially since 1888, the date of Baker's "Handbook of the Amaryllideæ") is rather trying, except to the connoisseur who, unlike the general public, is chiefly interested in the larger-flowered forms and the novelties.

There are several types of minor importance. The autumn-flowering kinds, representing many Latin names, as *Octobrensis*, *Corcyrensis*, *Reginæ Olgæ*, are usually weak-growing plants. However, much is hoped from *G. Cilicicus*, especially by the florists, who have hitherto found no Snowdrop that could be profitably forced for Christmas. Doubleness seems to add nothing to the beauty of Snowdrops. So far it seems to have affected only the inner segments of *G. nivalis* and *G. Elwesii*. Yellow Snowdrops are also practically unknown in America. In these the heart-shaped spot and the ovary are yellow instead of green. Of these, *G. flavescens* is said to have brighter markings than *G. lutescens.*

W. M.

The Galanthus is a true winter flower, and one of the few kinds of bulbs which grow naturally in partial shade, and suffer by actual baking of the bulbs. They are found naturally in northern exposures, and conditions similar to these inure to their welfare in gardens. The October kinds must be grown in frames, for the leaves will not ripen in the open. The fall-flowering forms are mostly Grecian, and they all show a white line in the channeled face of their leaves. *G. nivalis* flowers in the writer's garden, at Elizabeth, N. J., in a mild January, and *G. Elwesii* is even earlier. Among the choicer kinds are *G. Imperati*, *G. Ikariæ* (very distinct, Scilla-like lvs.), *G. Whittalli* and *G. Melvillei major*, quite the finest forms of *G. nivalis*. For general culture no form of Galanthus is so universally satisfactory as *G. nivalis*. The writer has had diappointing results with *G. Fosteri*, and cannot see that *G. Caucasicus*, var. *maximus*, is any great gain in size.

The yellow markings on Snowdrops are signs of degeneracy. Among the flowers each season, though more frequent at some times than others, will be found those with light colored markings and occasionally some white ones, but these plants show lack of vigor. In *G. Elwesii* the spathes are sometimes 2-fld. instead of one. All the fall-flowering kinds are rather delicate and decidedly costly, and promise nothing for forcing. *G. Elwesii* would be best for gentle forcing. The fall-flowering kinds are probably all forms of *G. nivalis*, including *G. Olgæ*, which Baker keeps as a distinct species.

J. N. GERARD.

Index of names accounted for below:

Byzantinus, 12.
Cassaba, 5.
Caucasicus, 4.
Cilicicus, 2.
Corcyrensis, 1.
Elwesii, 5.
Erithræ, 5.
Fosteri, 9.
Græcus, 6.
grandiflorus, 11.
Ikariæ, 8.
Imperati, 3.
latifolius, 7.
maximus, 4, 11.
nivalis, 1.
ochrospilus, 5.
plicatus, 10.
robustus, 5.
unguiculatus, 5.
Whittalli, 5.

A. *Lvs. merely channeled, not plaited.*

B. *Width of lvs. small, 3–4 lines.*

C. *Base of lvs. not very narrow.*

1. **nivàlis**, Linn. COMMON SNOWDROP. Figs. 888, 889. Bulb 6–12 lines thick: basal sheath split down one side: lvs. glaucous, finally 6–9 in. long: outer perianth segments oblong, 6–12 lines long; inner segments green only at the sinus. Feb., Mar. Pyrenees to Caucasus. R. H. 1880, p. 148. G.M. 34:154. G.C. II. 11:237. Gt. 48, p. 232. There are large-fld. and double forms. Var. **Corcyrénsis** and others flower in Nov. At least 2 varieties have yellow instead of green markings. Var. **refléxus** has outer segments reflexed. G.M. 34:155.

CC. *Base of lvs. very narrow.*

2. **Cilícicus**, Baker. Less robust than Fosteri, with much narrower lvs., which are narrowed gradually from the middle to a very narrow base. Green color as in nivalis. Bulb ½in. thick: lvs. whitish beneath; outer segments oblong, 9 lines long, 3-4 lines broad: stamens more than half as long as the inner segments. Mt. Taurus, in Cilicia, where it fls. Nov. to Mar. Int. 1898. See G. C. III. 21:214. Pictured in G. C. III. 23:79. A. F. 13:1137. Gng. 6:244. F.E. 11:282. Gt. 48, p. 228.

BB. *Width of lvs. medium, 6–9 lines long.*

C. *Foliage moderately glaucous.*

D. *Outer segments of perianth 12–15 lines long.*

3. **Imperàti**, Bertol. Fls. larger than in *G. nivalis;* outer segments more spatulate. Naples and Genoa. This and Caucasicus are regarded by Baker as subspecies of nivalis. G.C. II. 11:237. G.M. 34:155.

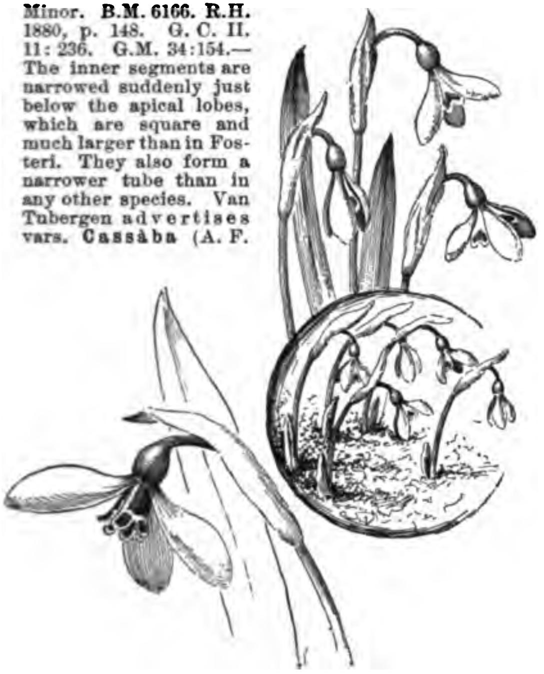
DD. *Outer segments 9–12 lines long.*

4. **Caucásicus,** Baker (*F. Redoùtei*, Rupr.). Lvs. finally 8–9 in. long, mostly 9 lines broad; outer segments oblong-spatulate, with a very narrow claw. Fls. later than nivalis. Caucasus. Van Tubergen seems to catalogue var. **máximus** of this species, but consult No. 11.

CC. *Foliage very glaucous.*

D. *Inner segments with lobes rather spreading or crisped.*

5. **Élwesii,** Hook. GIANT SNOWDROP. Fig. 889. Bulb larger and fls. more globose than in nivalis: outer segments oblong-spatulate, 9–15 lines long, 6–9 lines broad: inner segments green in the lower half and also around the sinus. Mts. of Asia Minor. B.M. 6166. R.H. 1880, p. 148. G. C. II. 11:236. G.M. 34:154.—The inner segments are narrowed suddenly just below the apical lobes, which are square and much larger than in Fosteri. They also form a narrower tube than in any other species. Van Tubergen advertises vars. Cassàba (A. F. 3:471. Gng. 5:180 Gt. 48, p. 225. Gn. 55, p. 206), **ochrospilus, unguiculàtus** (G. C. III. 17:361), and **Erithræ,** or **Whittalli** (Gn. 57, p. 45), which has the largest fls. *G. robústus*, Hort., seems never to have been accounted for by Baker. It may perhaps be *G. Elwesii*, var. *robustus* which is a trade name. It is broad-lvd. and glaucous.



889. Galanthus nivalis and Elwesii.

The upper fls. are *G. nivalis*. The lowest one is *G. Elwesii*. The middle fls. are a variety of *G. Elwesii.*

DD. *Inner segments with lobes not spreading or crisped.*

6. **Græcus,** Orph. Very near Elwesii, but differing as above and in the smaller fls. and narrower outer segments. April. Chios.

BBB. *Width of lvs. greatest, 9–12 lines.*

C. *Green color only near the sinus.*

D. *Colored on both sides of the inner segments.*

7. **latifòlius,** Rupr. Bulb 1 in. thick: lvs. lorate, bright green; outer segments oblong-spatulate, 6–9 lines long; inner segments green around the sinus, inside and out: anthers suddenly narrowed to a sharp point, while in nivalis and Elwesii they are gradually narrowed. Caucasus, where it fls. in May. G.C. II. 11:237; 15:404; 1868:578. Gt. 48, p. 229.

DD. *Colored on only one side.*

8. **Ikàriæ,** Baker. Resembles Fosteri in foliage, and Elwesii not in coloring but in the square, crisp lobes of the inner segments, which tend to recurve. Outer segments nearly 1 in. long: stamens rather shorter than the inner segments; green color occupying half the outside of the inner segments. Island of Nikaria (the classical Ikaria). See G C III. 13:506. Gn. 52, p. 361 and 49, p. 330. Int. 1893.

CC. *Green color also on the lower half of the inner segments.*

9. **Fósteri,** Baker Resembles latifolius in foliage and Elwesii in flower, but the apical lobes of the inner segments are short and erect, and smaller than in Elwesii. Also the stamens are not more than half as long as the inner segments, while in nivalis, Elwesii and latifolius they are three-fourths as long. Asia Minor. Int. 1889. G.M. 34:154.

AA. *Lvs. plaited, the edges permanently rolled back.*

B. *Green color only near the sinus.*

10. **plicàtus,** M. Bieb. Bulb larger than in nivalis: outer segments oblong from a very narrow base, very convex on the back, 9–12 lines long, wide-spreading or even reflexed: inner segments green in the upper half, with a white edge. March, April. Crimea. This is much confounded with *G. Caucasicus*. G.C. II. 11:236. B.R. 7:545. B.M. 2162. G.M. 34:155.

11. **grandiflòrus,** Baker (*G. máximus*, Baker, not Velatowsky). Possibly a hybrid between plicatus and some form of nivalis, remarkable for its robust habit and green color, extending more than half way down towards the base of the inner segments. Int. 1893. See G.C. III. 13:354, 656. See also *G. Caucasicus*, var. *maximus*, No. 4.

BB. *Green color also on the lower half o· the inner segments.*

12. **Byzantinus,** Baker. Intermediate between plicatus and Elwesii. "Lvs. 3 in. broad," which seems hardly possible, glaucous on both sides, especially beneath; margins distinctly and permanently recurved; outer segments oblong, convex on back, 9 lines long, 4 lines broad, apical lobes somewhat reflexed and crisped: stamens much shorter than inner segments. Int. 1893. See G.C. III. 13:226

W. M.

GÀLAX (Greek, *gala*, milk; alluding to the whiteness of the flowers). *Diapensiàceæ*. Galax lvs., with their lovely shades of red or bronze, furnish some of the most artistic decorative material for Christmas. The diapénsia family has only 6 genera, and all of them are monotypic or nearly so. The family seems to be nearly crowded out in the struggle for existence, and its geographical distribution is interesting. Galax is distinguished from the other genera by the corolla 5-parted, with entire segments: stamens connate with the spatulate staminodes: anthers 1-celled: style very short. The plant has long been cult. in hardy borders and rockeries for its beautifully tinted, persistent lvs. and its slender spikes of fls. borne in July. The plant grows about 6–9 in. high, and is native to the mountains of Virginia to Georgia. J. B. Keller recommends a northern aspect in the lower part of the rockery, where the plants can have shade and moisture. Prop. by division. Galax is usually called "Coltsfoot."

aphýlla, Linn. GALAX. Rhizome perennial: lvs. all from the root, heart- or kidney-shaped, crenate-dentate, often tinged with red or bronze, with radiating nerves and slender petiole, sheathing at the base. B.M. 754. G.F. 5:605. "Aphylla" means "leafless," referring to the scape.

W. M.

The use of Galax leaves for decorative purposes in a commercial way dates back only to 1890, when they were introduced to the northern florist trade by the writer, who had experimented with them for several years before that date, sending to hospitals and individuals. The reports received fully justified the introducer in advertising the leaf widely as a florist's decorative material for making wreaths, crosses, and in fact all designs for which ivy leaves up to that time had been employed almost exclusively. To-day Galax leaves have to a great extent taken the place of ivy leaves, being less expensive, easier handled and kept, and furnishing long, wiry stems. The brilliant bronze leaves supply a color long needed in this class of work. The sizes of the leaves vary, also, from ½ inch or less to 5 inches in diameter, further extending their usefulness. Small green Galax leaves are now used extensively for bunching with violets, taking the place of the violet leaves. One of the features of the holiday season in Boston is the fakir with his stand of violets bunched with green Galax. They come in again and are used the same way at the first touch of spring, when the early trailing arbutus or "Mayflower" appears on the street. They can be arranged to cover much more space than the ivy leaves, and do not have to be wired, as is the case with the latter. The keeping qualities of Galax are remarkable, and they are now used the year round from cold storage. Outdoor designs, as in cemeteries, will keep fresh and bright for months if not dried out, but otherwise require no care. A favorite arrangement of Galax leaves is to place them loosely in a small vase, where they will retain their bright colors and shape for weeks even in a close, warm room, though most of the leaves are used, commonly with flowers, in designs made up by the florist. As a Christmas decoration they stand preëminent, and their general good qualities mentioned above cause them to be used throughout the year, more, perhaps, than any other decorative green, ferns possibly excepted.

In Philadelphia a few seasons ago an enterprising young woman introduced a novel and taking innovation in the shape of potted Galax plants for society dinners. Small, brilliantly colored green and bronze lvs. were arranged in tiny pots, specially designed by Messrs. Sackett & Company, and placed at each plate, to be carried away by the guests as souvenirs. They were also sold through one of Philadelphia's leading merchants by thousands. The larger cities, Boston, New York, Philadelphia and Chicago, use the largest quantities, though many of these are retailed again to smaller cities and towns all over the United States and Canada, and there is a large export trade now established in them, mostly to Germany and the Netherlands. In 1899–1900, about 70 tons were sold.

The area over which Galax is collected extends from Virginia to Georgia, and is so vast that there is no danger of exterminating the plant by collecting the leaves, even if it were injured thereby, which does not seem to be the case. It is not practicable to grow the plants for the harvest of leaves, at least in America, the process being too expensive. Under cultivation they would perhaps not average one perfect salable leaf per plant, as a speck or wormhole renders the leaf unfit for decorative purposes. In Europe Galax has been tried with varying success under glass, the leaves bringing a very high price.

Galax aphylla is a beautiful ground-covering plant, specially adapted to the Rhododendron border, where the soil and situation alike are suitable to its growth, an delights in shade and a cool, moist, peaty loam. Its charms are far better known in England, however, than at home. The leaves, when full grown, are always bright green, the brilliant bronze shades appearing later when the plant ripens and the frosts begin. Then when they are exposed to the direct rays of the sun the alternating freezing and sun action cause the leaves to turn in a short time, though sometimes this occurs to an extent before any freezing weather. In dense shade they always remain green. In spring, when the sap begins to start, the leaves often turn green or dingy again, and eventually die down the second season.

Harlan P. Kelsey.

GALEÁNDRA (Greek for *helmet* and *stamen*). *Orchidàceæ*, tribe *Vándeæ*. A genus of deciduous epiphytes. Lvs. distichous, membranaceous: labellum infundibuliform: sepals and petals equal, spreading: column erect, winged: pollinia 2. Culture as for Eulophia.

Devoniàna, Lindl. Stem erect: lvs. linear-lanceolate, sheathing at base: sepals and petals lanceolate, reddish brown, with green margins; labellum whitish, veined in front with crimson. From the banks of the Rio Nigro. B.M. 4610. I.H. 21:176. A.F. 6:609.

Baùeri, Lindl. Stems subcylindric, nearly fusiform: lvs. lanceolate: racemes terminal, drooping: fls. large; sepals and petals similar, lanceolate, yellowish; labellum pale yellow in the throat, interior portion purplish. Mex. S. B.R. 26:49. P.M. 14:49.

D'Escagnolleàna, Reichb. f. Stems terete, tapering both ways: lvs. lanceolate, pointed: racemes terminal and drooping: sepals and petals similar, ascending, narrow, yellowish; lip funnel-form or nearly bell-form, fluted, with a rose-purple blotch on the lower limb. Brazil. I.H. 34:22 (1887).

Oakes Ames.

GALÈGA (Greek, *gala*, milk: supposed to increase the flow of milk). *Leguminòsæ*. Of 109 names of species in this genus, only 6 are now retained, most of the rest being referred to Tephrosia. The 2 plants mentioned below are hardy herbaceous perennials of the easiest culture, about 3 ft. high, with odd-pinnate lvs. and pea-shaped fls. of purplish blue or white. They do not require frequent division, make bushy plants, and bear in July and Aug. many dense, axillary and terminal racemes of fls., which are useful for cutting. Seeds of Goat's Rue are still offered abroad among miscellaneous agricultural seeds, but the plants are little known in this country.

A. *Leaflets lanceolate: stipules broadly lanceolate.*

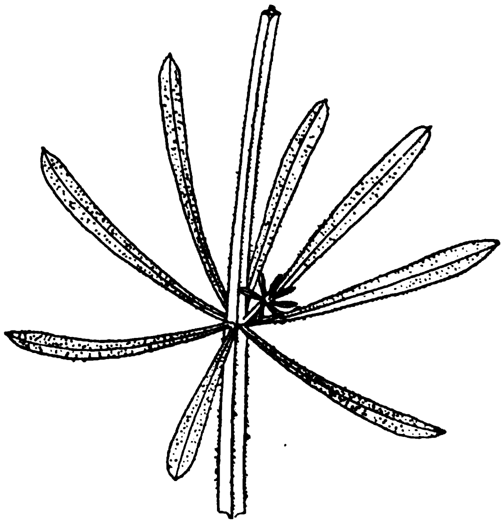
officinàlis, Linn. Goat's Rue. Height 2–3 ft.: lfts. mucronate: fls. purplish blue. Eu., W. Asia. Var. **álba** or **álbiflora** is commoner in cult. Gn. 50, p. 269.—A rose-colored variety is sold abroad; also a dwarf, compact, lilac-fld. variety.

AA. *Leaflets lanceolate: stipules broadly ovate.*

orientalis, Lam. Foliage and stipules larger: fls. purplish blue, nodding: pods pendulous. Caucasus. B.M. 2192. B. R. 4:326.—"Height 2½–4 ft.: rootstock creeping: stem simple." *J. B. Keller.*

J. B. Keller and W. M.

GÀLIUM (Galion was the name of a plant mentioned by Dioscorides as used in curdling milk. *G. verum* is used locally abroad for this purpose). *Rubiàceæ*. Bedstraw or Lady's Bedstraw, because of the legend that one of these plants was in the hay on which the mother of Christ rested. This genus contains 150–250 species, widely scattered in temperate regions, mostly weeds, often harsh to the touch, but frequently beautiful in their regular, mathematical habit, caused by the whorled arrangement of the lvs. A few plants are slightly used abroad in carpeting rockeries, but *G. Mollugo* is a standard plant with many florists who have a hardy border Their delicate sprays of minute white flowers



890. Whorled foliage of a Bedstraw—the native Galium Aparine. Natural size.

are used to lighten the effect of bouquets of other fls., notably sweet peas, which can hardly be arranged with their own foliage, and which in large masses are inclined to look heavy and lumpy. Gypsophilas, which are used for the same purpose, bloom later. They have an equal infinity of detail, which baffles the eye to comprehend. The botanist's analysis of all this misty delicacy and airy grace is "fls. in axillary and terminal, trichotomous cymes and panicles." He also declares that the lvs. are really opposite, the intervening members of the whorls being stipules. Fig. 890. Galiums are annual or perennial herbs, with 4-angled, slender stems and small, white, green, yellow or purple fls.; corolla wheel-shaped, 4-lobed; stamens 4: styles 2. The following are perennials from creeping rootstocks, with white fls. in terminal panicles.

A. *Lvs. in 4's: fruit hairy.*

boreàle, Linn. Height ½–1½ ft.: stem rather firm, erect and slightly branched: lvs. lanceolate or linear, 3-ribbed, scarcely rough at the edges, often 1 in. long: petals with very short, incurved points. Native.

AA. *Lvs. in 8's or 6's: fr. smooth or slightly granulated.*

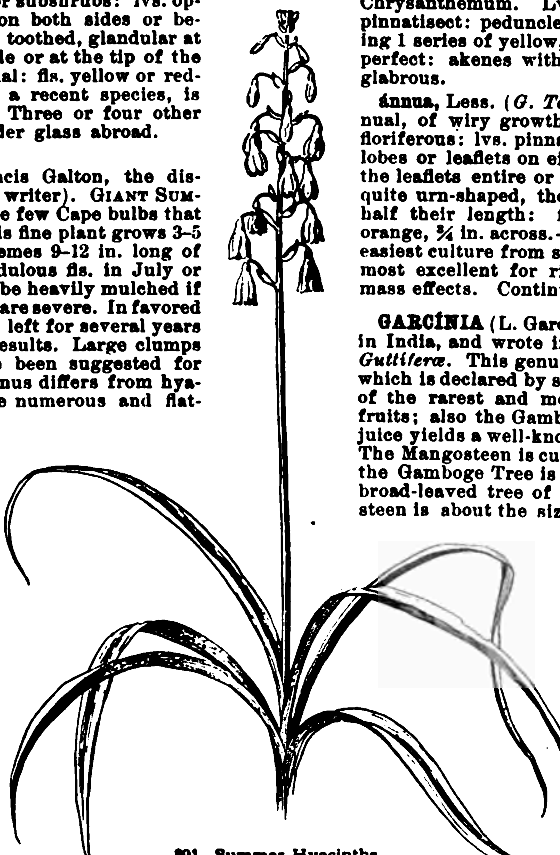
Mollùgo, Linn. Stem 1–3 ft. long, more or less branched: lvs. obovate to oblong or linear, more or less rough at edges, always terminated by a little point: petals abruptly narrowed into a relatively long point.—This is known in some places as "Baby's Breath," although that name is also given to Gypsophilas (which see). Eu. Perennial.

GALPHÍMIA (anagram of Malpighia). *Malpighiàceæ*, an order of almost no horticultural value. This genus includes a yellow-fld. shrub cult. in the extreme South, and valued for the exceptional length of its flowering season. The genus has a dozen or less species, mostly Mexican. Shrubs or subshrubs: lvs. opposite, slightly glaucous on both sides or beneath, entire or obscurely toothed, glandular at the margin or base of blade or at the tip of the leaf-stalk: racemes terminal: fls. yellow or reddish. *G. nitida*, probably a recent species, is cult. by E. N. Reasoner. Three or four other kinds are rarely cult. under glass abroad.

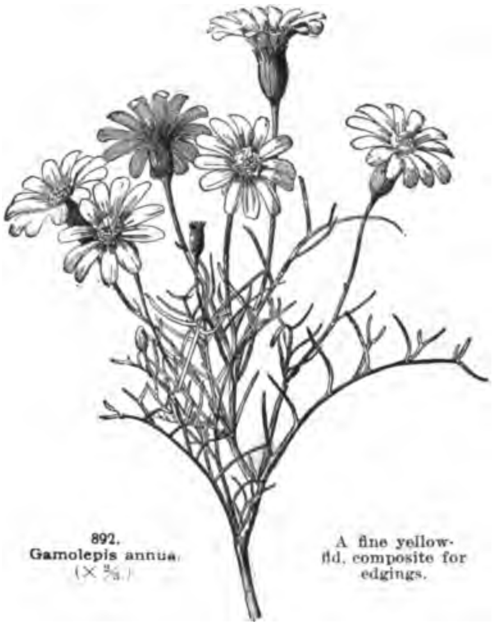
GALTÒNIA (after Francis Galton, the distinguished anthropological writer). GIANT SUMMER HYACINTH. One of the few Cape bulbs that are practically hardy. This fine plant grows 3–5 ft. high and produces racemes 9–12 in. long of white, funnel-shaped, pendulous fls. in July or later. The plants should be heavily mulched if left outdoors where winters are severe. In favored localities the bulbs may be left for several years with increasingly better results. Large clumps are desirable. They have been suggested for cemetery planting. The genus differs from hyacinths mainly by its more numerous and flattened seeds. The other 2 species are inferior to the following, which was introduced by Leichtlin in the early seventies, and now holds a permanent place in horticulture. The plants prefer a rich, open, moist soil:

cándicans, Decne. (*Hyacinthus candicans*, Baker). Fig. 891. Bulb large, round, coated: lvs. lorate-lanceolate, 2½ ft. long: scape often 4 ft. high: racemes 12–20-fld.: fls. fragrant. F.S. 21:2173. G.C. 1871:380: 1872:1099 and II. 15:273. R.H. 1882, p. 32. P.G. 3:101. A. G. 17:281. W. M.

GAMBOGE. See under *Garcinia*.



891. Summer Hyacinths. Galtonia candicans.



892. Gamolepis annua. (× ⅔.) A fine yellow-fld. composite for edgings.

GAMÓLEPIS (Greek for *united scales;* referring to the involucre). *Compósitæ*. About a dozen S. African herbs or small shrubs, somewhat allied botanically to Chrysanthemum. Lvs. alternate and mostly pinnatisect: peduncles 1-headed, the heads bearing 1 series of yellow, pistillate rays, the disk fls. perfect: akenes without pappus, wingless and glabrous.

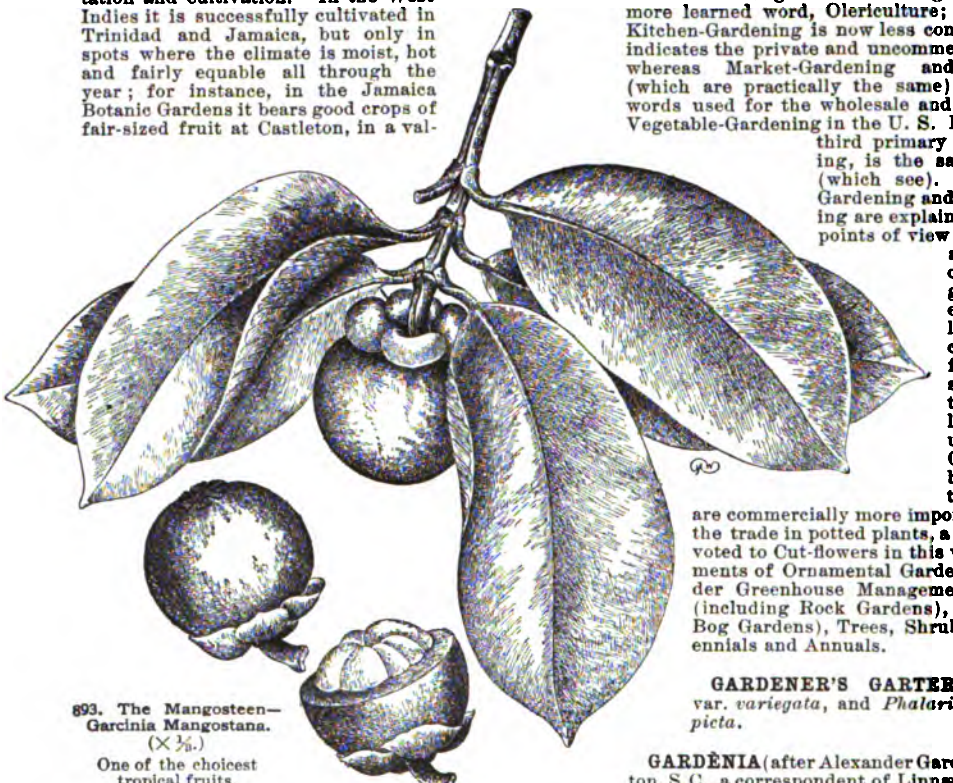
ánnua, Less. (*G. Tagètes*, DC.). Fig. 892. Annual, of wiry growth, a foot or less high, very floriferous: lvs. pinnate or pinnately parted, 5–7 lobes or leaflets on either side of the rachis and the leaflets entire or lobed: involucre nearly or quite urn-shaped, the scales joined more than half their length: fl.-heads bright yellow or orange, ¾ in. across.—Hardy or half-hardy. Of easiest culture from seeds in sunny places, and most excellent for ribbon borders and for low mass effects. Continuous bloomer. L. H. B.

GARCÍNIA (L. Garcin, who lived and collected in India, and wrote in the eighteenth century). *Guttiferæ*. This genus includes the Mangosteen, which is declared by some connoisseurs to be one of the rarest and most luscious of all tropical fruits; also the Gamboge Tree, whose resinous juice yields a well-known pigment and purgative. The Mangosteen is cultivated in the West Indies; the Gamboge Tree is also cult. in S. Fla. It is a broad-leaved tree of slow growth. The Mangosteen is about the size and shape of an orange, with rind considerably thicker, and edible segments of form and arrangement like those of an orange. It is brilliantly colored outside with rich purple. The persistent stigmas and calyx lobes are seen in Fig. 893. The flavor is said to suggest something between a grape and a peach. Numberless efforts are said to have been made to naturalize this tree in the tropics without success. The successful ripening of this fruit under glass is usually regarded as a consummate achievement in the art of gardening.

Mangostàna, Linn. MANGOSTEEN. Fig. 893. Height 20 ft.: lvs. 7–8 in. long, elliptic: fls. reddish; petals 4: fr. about 2½ in. in diam. B.M. 4847. L.B.C. 9:845. F.S. 22:2359. G.C. II. 4:657.

Morélla, Desr. GAMBOGE TREE. Height 30–50 ft.: lvs. more tapering at both ends: fls. yellowish: fr. resembling a Morello cherry in size and shape. W. M.

The Mangosteen is a native of the Malay peninsula and archipelago. It is cultivated, and bears fruit in some parts of Ceylon and in a few spots in the Madras Presidency, but no success has been obtained in its cultivation in other parts of India. DeCandolle, in his "Origin of Cultivated Plants," says: "Among cultivated plants it is one of the most local, both in its origin, habitation and cultivation." In the West Indies it is successfully cultivated in Trinidad and Jamaica, but only in spots where the climate is moist, hot and fairly equable all through the year; for instance, in the Jamaica Botanic Gardens it bears good crops of fair-sized fruit at Castleton, in a valley on the north side, with a mean temperature of 76° F. and an annual rainfall of 113 inches, whereas attempts to grow it have failed at Hope Gardens, in the Liguanea plain of the south side, with a mean temperature of 72° and an annual rainfall of 52 inches. Experience in southern India is much the same; it will grow only in valleys,—not in the open plains. In England the tree has been grown in hothouses and the fruit ripened successfully.



893. The Mangosteen—Garcinia Mangostana. (× ⅓.) One of the choicest tropical fruits.

The Gamboge Tree is much more widely distributed, being native throughout India, Ceylon, Malaya and Siam. As one might expect, its cultivation is easy, as it stands a considerable amount of variation of moisture and heat. In Jamaica it has become naturalized in some parts of the wetter districts. WM. FAWCETT.

GARDEN and GARDENING. The word Garden etymologically means an inclosed space, and Gardening is, therefore, distinguished from agriculture by being carried on within an inclosure of some kind instead of in the open fields. Gardening operations are usually conducted on a smaller scale than those of agriculture, and by more intensive methods. Gardening and horticulture are really synonymous terms, but, by usage, a horticulturist is supposed to have a more extended training and wider range of activities than a gardener. Moreover, the word Gardening now suggests more of the private, homelike and personal point of view, whereas the most distinctive feature of American horticulture is the immense commercial importance of fruit-growing on a greater scale than that of Old World Gardening, and a marked emphasis of the professional side of a fruit-grower's work. The history and discussion of Gardening are, therefore, set forth in this book under Horticulture. Large private places are often divided into Fruit Garden, Kitchen Garden and Flower Garden. Fruit-growing is the same as Pomology (which see). Kitchen-Gardening, in its widest sense, is the same as Vegetable-Gardening (which see), or the more learned word, Olericulture; but the expression Kitchen-Gardening is now less common, and generally indicates the private and uncommercial point of view, whereas Market-Gardening and Truck-Gardening (which are practically the same) are now the chief words used for the wholesale and commercial side of Vegetable-Gardening in the U. S. Flower-Gardening, a third primary division of Gardening, is the same as Floriculture (which see). Under Ornamental Gardening and Landscape Gardening are explained the two different points of view in the use of plants and flowers for their own sakes or when grouped for artistic effects, the nature-like or picturesque conception being set forth under Landscape Gardening, and the artificial or merely decorative styles under Ornamental Gardening. America being the only country where cut-flowers are commercially more important at present than the trade in potted plants, a special article is devoted to Cut-flowers in this work. Other departments of Ornamental Gardening are treated under Greenhouse Management, Alpine Gardens (including Rock Gardens), Aquatics (including Bog Gardens), Trees, Shrubs, Herbaceous Perennials and Annuals.

GARDENER'S GARTER. *Arundo Donax*, var. *variegata*, and *Phalaris arundinacea*, var. *picta*.

GARDÈNIA (after Alexander Garden, M.D., of Charleston, S.C., a correspondent of Linnæus). *Rubiàceæ*. This includes the Cape Jasmine, a tender shrub 2–6 ft. high, with thick, evergreen foliage and large double, waxy Camellia-like, fragrant fls. It blooms from May to Sept. in the South, where it is often used for hedges, and is hardy as far north as Va. In the middle of the century the Cape Jasmine was considered one of the finest stove shrubs in cultivation, but with the waning popularity of Camellias the doom of the Cape Jasmine as a conservatory plant was sealed. The Camellia has a greater range of color, and has had hundreds of varieties, while its scented rival has had barely a dozen. The flowers of the Cape Jasmine have never been so perfectly regular as those of a Camellia, and the plants are very subject to insect enemies. Their bloom is successional rather than close, and large plants are therefore not so showy as Camellias. They are considerably grown abroad for cut-fls. in early spring, young plants a season or two old being used for best results. The variety with variegated foliage is dwarfer and weaker growing. The true botanical name of the Cape Jasmine is *G. jasminoides*, a name almost never used in the trade. "Cape Jasmine" itself is one of the most remarkable cases of the vitality of an erroneous popular name. The single-fld. form was introduced much later than the double, and has always been less popular. The earliest picture of a living plant with single fls. was published in 1820 in B.R. 449. Some fine plants still known to the trade as Gardenias are now placed in the allied genera Randia and Mitriostigma. These two genera have a many-celled ovary, while that of Gardenia is 1-celled. The calyx in Gardenia is often tubular, in Mitriostigma 5-parted, in Randia various. The testa of the seeds is membranaceous in Randia; in Mitriostigma rather fibrous. Gardenias are obtainable chiefly through southern and Californian dealers. Cape Jasmines are also handled by importers of Japanese plants, who sometimes offer seeds also. *G. lucida* was probably introduced by Reasoner, and *G. Rothmanni* by Franceschi. For the true Jasmines (which belong to the olive family, and are often trailing plants), see *Jasminum*.

G. florida and *G. radicans* have long been figured separately, and our nurserymen still keep the names distinct. The only difference which DeCandolle records is that *G. florida* is more shrubby and erect, with elliptical lvs. acute at both ends, growing spontaneously in China and cult. in Japan, while *G. radicans* has a stem that takes root, lanceolate lvs., and is a native of Japan. Both plants, DeCandolle wrote, were cult. in India and at the Cape. Ellis founded the genus upon a double-fld. specimen, which he figured in the Phil. Trans. Roy. Soc. Lond. in 1761. In 1816 Sims pictured a double form in B.M. 1842 with these remarks: "In the way that *Gardenia radicans* is treated in our stoves, the stems show no disposition to put forth roots; but probably would were they suffered to come in contact with the earth. It is doubtful whether it has ever been seen in this country, or even in China, with a single flower. There is a great affinity between this species and *Gardenia florida*, from which it differs very little, except in the lesser size of its flowers and leaves, which last are narrowed at both extremities. The flowers have nearly the same fragrant smell, and the plant, flowering more freely and being more easily propagated than the true Cape Jasmine, it has of late much taken the place of this last, and is frequently sold for it." Before 1820, Sir J. Smith wrote in Rees' Encyc.: "The original idea and character of this genus are taken from *G. florida*, commonly called 'Cape Jasmine.' This was first brought to England by Capt. Hutchinson (of the Godolphin Indiaman), who, about the middle of the last century, met with a bush of it in full flower, somewhere near the Cape of Good Hope, probably in a cultivated state. He brought the whole plant in a pot to England. * * * Mr. Gordon, the nurseryman, having obtained layers from the tree, propagated it so successfully that he is said to have gained more than 500 *l.* by the produce. It is now frequent in our gardens, treated as a stove plant, though it chiefly requires heat in the early spring to make it bloom, being at other times a hardy greenhouse plant. The flowers are the size and aspect of a double *Narcissus poeticus*, with a sweet and very powerful scent, resembling the flavour of ginger. They turn buff as they fade." From the above evidence, and from the pictures cited below, it seems clear that if the trade names *G. Fortunei*, *florida* and *radicans* really represent 3 distinct varieties, the only single distinction that can be made is in width of foliage; *Fortunei* having lvs. 2 in. wide, *florida* 1-1½ in., and *radicans* ½-1 in. wide.

A. *Corolla tube cylindrical.*

B. *Calyx with 5 long teeth.*

C. *Ribs on the calyx.*

jasminoides, Ellis. (*G. flórida*, Linn. *G. radicans*, Thunb.). CAPE JASMINE. Discussed above. For pictures of double forms, see B.M. 1842 and 2627 and B.R. 1:73; single, B.R. 6:449 and B.M. 3349; normal and variegated foliage, R.H. 1864, p. 30. China. Var. **Fortuniàna**, Lindl. (*G. Fórtunei*, Hort.). B.R. 32:43. F.S. 2:177. R.B. 23:241. In 1893 John Saul advertised *G. camelliæflòra* in addition to *G. radicans*, *G. florida* and vars. *màjor* and *majéstica*. *G. Sinénsis grandiflòra* of Berger's catalogue perhaps belongs here.

CC. *Ribs not present.*

lùcida, Roxb. Buds resinous: lvs. oblong: stipules annular, variously divided at the mouth, unequally lobed. India, Burma, Luzon.—The calyx teeth are not decurrent, as in the Cape Jessamine, and thus the calyx does not have the ribbed look.

BB. *Calyx tubular, with 5 very short teeth.*

amœ̀na, Sims. Differs from all here described in having numerous strong spines nearly ½ in. long, which are axillary. Lvs. oval, acute, short-stalked: fls. subterminal; corolla tube 1 in. long, longer than the lobes, which are 6, obovate, white, with margins incurved enough to show the rosy back. India or China.

BBB. *Calyx spathe-like.*

Thunbérgia, Linn. f. Lvs. broadly elliptic, acute, with pairs of glands along the midribs: fls. 3 in. across, pure white; corolla lobes 8, overlapping. S. Afr. B.M. 1004. —"Dwarf-growing."—*Franceschi.*

AA. *Corolla tube short and wide-throated.*

B. *Fls. 3 in. long and broad.*

Rothmánnia, Linn. f. Very distinct in foliage and fl. Lvs. with pairs of hairy glands along the midrib: calyx ribbed, with 5 long teeth, equaling the short, cylindrical portion of the corolla tube; corolla tube rather suddenly swelled, ribbed: lobes 5, long-acuminate, whitish, spotted purple in the mouth. S. Afr. B.M. 690. L.B.C. 11:1053.—"Fls. pale yellow."—*Franceschi.*

BB. *Fls. 1½ in. long and broad.*

globòsa, Hochst. Lvs. oblong, short-acuminate; leafstalk nearly 3–5 lines long: fls. white, inside hairy and lined pale yellow; calyx small, with 5 very short teeth; corolla tube wide at the base and gradually swelled; lobes 5, short-acuminate. S. Afr. B.M. 4791. F.S. 9:951.

G. citriodòra, Hook.—Mitriostigma axillare.—*G. Stanleyàna*, Hook.—Randia maculata.

W. M.

Gardenia jasminoides (the true Cape Jasmine) has again become very popular, even suggesting its popularity thirty years ago, when its wax-like, fragrant blossoms were highly fashionable. Then several of the leading florists erected special houses for it, in order that they might flower it in the winter season. The writer had charge of one of these houses. The attempt to bloom them in midwinter was, however, only partly successful, for it is against the nature of the plant to force it into bloom before the turn of the sun in, say, January. If the plants have been well established the previous summer and are well set with flower buds, they can be successfully forced into bloom in a sunny greenhouse, giving them stove heat and frequent syringings with tepid water. The plants will be entirely covered with their great blossoms. To grow and prepare such plants, cuttings with two or three joints or eyes of well-ripened wood should be made in December or January, putting them into the propagating bed of sharp sand, with a bottom heat of not less than 75°, and keeping close until callused. Then air can be admitted. After rooting, they should be potted into small pots and grown on until the middle of May, when they can be planted out into a coldframe or old hotbed, into a rich, sandy loam, giving them the full sun and treating them the same as *Ficus elastica* is now grown. Abundance of water and frequent syringing are essential. Pinch the shoots, so as to make the plants bushy and branchy. In the latter part of August or beginning of September the plants should be potted into 5-, 6- or 7-inch pots, according to their size, then placed either in a hotbed with gentle bottom heat or in a house where a moist stove temperature can be maintained until the plants are well rooted. During this period they should be slightly shaded, after which the plants can be hardened off and put into their winter quarters. Put in a cool greenhouse where Azaleas or Camellias or other New Holland or Cape stock is wintered, until their time for forcing into flower arrives, in the early part of the new year.

There is considerable difference between the large-leaf or Fortuniana variety and the common *G. jasminoides*. While the same treatment will answer for both, and the fl. of the former is much larger, it is not so profitable for commercial purposes as the ordinary *G. jasminoides*. There is also a difference between these and the variety known as *G. radicans*, and its variegated variety, *radicans fol. var.* These plants grow much dwarfer, and their habit is more radicant or flat or prostrate in growth. Their foliage is myrtle-like and the flowers are much smaller and are less valuable. These, however, make good flowering (dwarf) pot-plants under similar treatment. The variegated form is cultivated in great abundance in Japan, in the gardens in semi-tropical sections. None of the other varieties is of much commercial importance, and they have value only in botanical collections.

H. A. SIEBRECHT.

GARDEN LEMON. See under *Cucumis Melo.*

GARDÒQUIA betonicoides = *Cedronella Mexicana.*

GARLAND FLOWER in the South sometimes means *Hedychium coronarium.* Often means *Daphne Cneorum.*

GARGET. *Phytolacca decandra.*

GARLIC (*Allium sativum*, Linn.). Hardy perennial bulbous plant, closely allied to the onion. It is native of southern Europe. It has flat leaves, and the bulb is composed of several separable parts or bulbels, called cloves. These cloves are planted, as onion sets are, in spring or in fall in the South. They mature in summer and early fall. If the soil is rich, it may be necessary to break over the tops to prevent too much top growth and to make the bulbs better, as is sometimes done with onions. This is done when the top growth has reached normal full size. The cloves are usually set 4–6 in. apart in drills, in ordinary garden soil. The bulbs are used in cookery, but mostly amongst the foreign population. Strings of bulbs braided together by their tops are common in metropolitan markets (Fig. 894).
L. H. B.

894. Garlic, as strung for market.

GARLIC PEAR. See *Cratæva.*

GÁRRYA (after Nicholas Garry, secretary of the Hudson Bay Company). Including *Fadyènia. Cornàceæ.* Ornamental evergreen shrubs with opposite, petioled, entire lvs., with the small greenish white or yellowish fls. in catkin-like, often pendulous spikes, and with dark purple or dark blue berries. None of the species is hardy North, but *G. Veatchi*, var. *flavescens*, and also *G. Fremonti*, which are the hardiest, can probably be grown north to New York in sheltered positions, while the others are hardy only South. They are well adapted for evergreen shrubberies, and the staminate plants are especially decorative in early spring with the showy, pendulous catkins, which in *G. elliptica* attain to 1 ft. in length and often bloom in midwinter. The Garryas thrive well in a well-drained soil and in sunny, sheltered position; in England they are often grown on walls. Prop. by seeds or by cuttings of half-ripened wood under glass; also by layers and sometimes by grafting on Aucuba. About 10 species in W. N. America from S. Oregon to S. Mexico, west to W. Texas. Shrubs with exstipulate lvs.: fls. diœcious, apetalous, 1–3 in the axils of opposite bracts on elongated, often drooping, axillary spikes; staminate fls. with 4 sepals and 4 stamens, pistillate with 2 sepals and 2 styles and a 1-celled ovary: berry 1–2-seeded, rather dry.

elliptica, Dougl. Shrub, to 8 ft.: lvs. elliptic to oval-oblong, obtuse or acute, usually undulate, glabrous above, densely tomentose beneath, 1½–3 in. long: 3 fls. in the axils of short and broad, pointed bracts; spikes rather dense, staminate 2–12 in. long, often branched, pistillate 1–3 in. long: fr. globose, silky tomentose. Calif. to New Mex. B.R. 20:1686. Gn. 33, p. 562; 51, p. 257; 53, p. 449; 55, p. 258.—This is the handsomest species, and stands about 10° of frost (sometimes more) in a sheltered position.

Thuréti, Carr. (*G. elliptica* × *Fadyeni*). Shrub, to 15 ft.: lvs. elliptic to elliptic-oblong, at length glossy and glabrous above, whitish tomentose beneath, 2–5 in. long: bracts remote, ovate-lanceolate, with usually 1 fl. in each axil; spikes shorter than those of the former: fr. ovoid, tomentose. Originated in France. R.H. 1869. p. 17; 1879, p. 154, 155.

G. Fádyeni Hook. (Fadyenia Hookeri, Griseb.). Shrub, to 15 ft.: lvs. elliptic to oblong, acute or mucronulate, glossy above, tomentose beneath or almost glabrous at length, 2–4 in. long: bracts oblong-lanceolate, remote: fr. tomentose. Jamaica. Cuba.—*G. Frèmonti*, Torr. Shrub, to 10 ft.: lvs. ovate to oblong, acute, glabrous on both sides, yellowish green, 1–3 in. long: spikes dense, 2–5 in. long, with short bracts: fr. pedicelled, glabrous. Ore. to Calif. G.C. II. 15:431.—*G. macrophýlla*, Benth. Shrub, to 6 ft.: lvs. ovate to oblong-ovate, glabrous above, villous-pubescent beneath, 2–5 in. long: spikes dense and short: fr. sessile. Mexico.—*G. Veatchi*, Kellogg. Spreading shrub, to 8 ft.: lvs. elliptic-ovate to elliptic-oblong, acute, yellowish green, silky-tomentose beneath, 1½–2½ in. long: spikes dense, 1–2 in. long: fr. sessile, usually silky tomentose. Nevada to Calif. and N. Mex.—Var. *flavéscens*, Coult. & Evans (G. flavescens. Wats.), has the lvs. smaller, longer petioled and less pubescent; it is the more northern form and hardier. Species named for J. A. Veatch, botanical explorer of Cedros Island, Lower California.
ALFRED REHDER.

GARÙGA (native name). *Burseràceæ.* This includes a deciduous East Indian tree, reaching 60 ft., and cult. in S. Fla. and Calif. for its fruits, which are the size of a gooseberry, and are eaten raw, but chiefly pickled. The genus has 6 species in tropical Asia, Amer. and Australia. Tomentose trees: lvs. crowded at tips of branches, alternate, odd-pinnate; lfts. opposite, subsessile, serrate: fls. polygamous, panicled; calyx bell-shaped, 5-cut; petals 5, inserted on the tube of the calyx above the middle: ovary 4–5-celled; ovules in pairs: drupe with 5, or by abortion 1–3, stones, which are wrinkled and finally 1-seeded.

pinnàta, Roxb. Lvs. nearly villous; lfts. obtusely crenate. India and Malaya.—Also cult. abroad under glass.

GAS PLANT. Consult *Dictamnus.*

GASTÈRIA (Greek, *gaster*, belly; referring to the swollen base of the fls.). *Liliàceæ.* About 50 species of greenhouse evergreen succulents, allied to Aloe, and native of South Africa. Rather small plants, mostly acaulescent, with usually elongated leaves, crowded in 2 ranks or a loose rosette. Flowers with a rosy ventricose, curved tube and short, suberect, greenish segments, about as long as the stamens and pistil. Several species are proliferous on aborted peduncles. Hybrids are frequent between the species, and with other genera of the tribe. Gasterias flower in winter. For culture, see *Aloe.*

A. *Leaves tapering gradually to the point, concave-convex or concavely 3-sided.*

verrucòsa, Haw. (*Alòe verrucòsa*, Mill.). Lvs. in two straight or at length twisted ranks, narrow for the genus, dull gray, very rough, with small white tubercles. Cape. B.M. 837.

carinàta, Haw. (*Alòe carinàta*, Mill.). Lvs. at length spreading in every direction, an inch or more broad, mostly inequilaterally 3-sided, dull, greener, the greener protuding tubercles coarser and more separated. B.M. 1331 (except left-hand leaf).

excavàta, Haw. Like the last, but without raised tubercles. Doubtfully distinct from the next. Cape.

glàbra, Haw. (*Alòe glàbra*, Salm-Dyck. *A. carinàta*, var. *subglàbra*). Lvs. larger, green, somewhat glossy, some of the coarse, remote, pale dots persistently elevated. Cape. B.M. 1331 (left-hand leaf).

acinacifòlia, Haw. (*Alòe acinacifòlia*). Lvs. dark green, more elongated, somewhat glossy, the scattered pale dots not raised. Cape. B.M. 2369.

pùlchra, Haw. (*Alòe púlchra*, Jacq.). Lvs. sometimes purplish, narrower and longer, the rather coarse, pale dots not elevated. Cape. B.M. 765.

nítida, Haw. (*Alòe nítida*, Salm-Dyck). Lvs. green, more or less glossy, short, deltoid, very thick, the coarse, pale dots not elevated, and the margins nearly smooth. Cape. B.M. 2304.

AA. *Leaves with nearly parallel margins, abruptly pointed or mucronate.*

B. *Leaves strap-shaped, one or both faces flat or concave, the margins frequently doubled.*

intermèdia, Haw. (*G. verrucòsa*, var. *intermedia*). Lvs. 2-ranked, more rounded on the back than usual in the group, and some of them tapering as in *verrucosa*, grayish, rough, with numerous pale tubercles. Cape. B.M. 1322 (as *Aloe lingua*).

scabérrima, Salm-Dyck (*G. intermèdia*, var. *aspérrima. G. verrucòsa*, var. *scabérrima. Alòe scabérrima*). Lvs. thinner, less concave and tapering, often sword-shaped, very rough, with coarse white tubercles.

dísticha, Haw. (*G. denticulàta*, Haw. *Alòe dísticha*, Thunb. *A. lingua*, Thunb. *A. linguifórmis*, Mill.). Lvs. somewhat concavo-convex, from apple-green becoming dull gray, evanescently pale dotted, smooth, rough-margined. Cape.

Var. **conspurcàta,** Haw. (*G. conspurcàta*, Haw. *Alòe conspurcàta*, Salm-Dyck). Lvs. with less roughened margin, the numerous, more persistent, pale dots not elevated.

Var. **verrucòsa** (*Alòe linguifórmis*, var. *verrucòsa*). Lvs. roughened by the persistent elevation of some of the more remote greener dots.

Var. **angulàta,** Haw. (*Alòe angulàta*, Willd.). Lvs. nearly flat on both surfaces, one or both margins acutely doubled.

sulcàta, Haw. (*Alòe sulcàta*, Salm-Dyck). Lvs. very concave, with angular, conspicuously elevated and mostly incurved margins, the green dots sometimes protruding. Cape.

nígricans, Haw. (*Alòe nígricans*, Haw. *A. lingua*, var. *crassifòlia*). Lvs. plano-convex, rather turgid, from dark green with pale dots becoming uniformly purplish, smooth, the occasionally doubled margins very minutely roughened. Cape. B.M. 838 (as *Aloe lingua*, var. *crassifolia*).

Var. **subnígricans,** Haw. (*G. subnígricans*, Haw.). Greener, the sparse dots somewhat elevated and the margins rough, especially below.

BB. *Leaves sword-shaped, turgid, polished.*

planifòlia, Bak. Lvs. 2-ranked, 2-edged, narrow, long, biconvex, dark green, with numerous rather large, often confluent pale blotches, the margin denticulate next the apex. Algoa Bay.

maculàta, Haw. (*Alòe maculàta*, Thunb. *A. obliqua*, Haw.). Lvs. obliquely 2-ranked, occasionally 3-edged, often twisted, broad, with confluent pale blotches, the margin entire. Cape. B.M. 979.

picta, Haw. (*G.* and *A. Bowieàna*). Lvs. spirally 2 ranked on an elongated stem, somewhat purplish, broad, from biconvex becoming concave, smooth-margined or a little roughened near the middle. Cape.

marmoràta, Bak. Lvs. spirally 2-ranked, often 3-edged, narrow, elongated, smooth, entire or the lower partly rough-margined, highly polished, coarsely pale-marbled. Cape?

parvifòlia, Bak. Lvs. spreading in all directions, mostly 3-edged, very short and thick, duller green, with less confluent, small, pale dots, which are often slightly elevated. Cape.

WM. TRELEASE.

GASTÒNIA Palmata. See *Trevesia*.

GASTRONÈMA. A section of *Cyrtanthus*.

GAULTHÈRIA (named by Kalm after Dr. "Gaulthier," a physician in Quebec, whose name was really written Gaultier). *Ericàceæ*. This includes the Wintergreen and some other ornamental low aromatic plants with alternate, evergreen lvs., white, pink or scarlet, often fragrant fls. in terminal or axillary racemes or solitary, and with decorative, berry-like red or blackish fr. *G. procumbens* is fully hardy North, while the other N. American species need protection during the winter; they are well adapted for borders of evergreen shrubberies as well as for rockeries, and in suitable soil they are apt to form a handsome evergreen ground-cover. Most of the foreign species can be grown only South or as greenhouse shrubs. Some have edible fruits, and an aromatic oil used in perfumery and medicine is obtained from *G. procumbens* and several Asiatic species. They grow best in sandy or peaty, somewhat moist soil and partly shaded situations. Prop. by seeds, layers or suckers, division of older plants, and also by cuttings of half-ripened wood under glass. About 90 species in the warmer and subtropical regions of Asia, Australia, and in America from Canada to Chile. Erect or procumbent shrubs, rarely small trees, usually hairy and glandular: lvs. petioled, roundish to lanceolate, mostly serrate: fls. in terminal panicles or axillary racemes or solitary; calyx 5-parted; corolla urceolate, 5-lobed; stamens 10: ovary superior: fr. a 5-celled, dehiscent capsule, usually enclosed by the fleshy and berry-like calyx.

procúmbens, Linn. WINTERGREEN. CHECKERBERRY. BOXBERRY. PARTRIDGE BERRY. Stem creeping, sending up erect branches to 5 in. high, bearing toward the end 3–8 dark green, oval or obovate, almost glabrous lvs., 1–2 in long, with ciliate teeth: fls. solitary, nodding; corolla ovate, white, about ¼ in. long: fr. scarlet. July–Sept. Canada to Ga., west to Mich. D. 73. B.M. 1966. L.B.C. 1:82.

Shállon, Pursh. Low shrub, to 2 ft., with spreading, glandular-hairy branches: lvs. roundish-ovate or ovate, cordate or rounded at the base, serrulate, 2–4 in. long: fls. nodding, in terminal and axillary racemes; corolla ovate, white or pinkish: fr. purplish black, glandular, hairy. May, June. Brit. Columbia to Calif. Called "shallon" or "salal" by Indians. B.M. 2843. B.R. 17:1411. L.B.C. 14:1372.

G. antípoda, Forst. Shrub, to 5 ft., sometimes procumbent, hairy: lvs. orbicular to oblong, ¼–⅜ in.: fl. solitary, white or pink, campanulate. N. Zealand, Tasmania.—*G. coccínea*, HBK. Shrub, to 2 ft., hairy: lvs. roundish ovate, about 1 in.: fls. slender-pedicelled, in elongated, secund racemes; corolla ovate, pink. Venezuela. R.H. 1849:181.—*G. ferrugínea*, Cham. & Schlecht. Small shrub, rufously hairy: lvs. ovate or oblong. 1–2 in.: fls. almost like the former. Brazil. B.M. 4697.—*G. fragrantíssima*, Wall. Shrub or small tree, glabrous: lvs. elliptic to lanceolate, 2½–3½ in. long: racemes axillary, erect, shorter than the lvs.; corolla white or pinkish, globular ovate. Himalayas, Ceylon. B.M. 5984.—*G. nummularioides*, D. Don. (*G. Nummulària*, DC.). Procumbent: branches densely rufously hairy: lvs. orbicular to ovate, ½–1 in. long: fls. solitary, ovate, white. Himalayas. G.C. II. 22:457. P.F.G. 2:164.—*G. ovatifòlia*, Gray. Procumbent, with ascending and sparingly hairy branches: lvs. ovate, acute, 1–1½ in. long: fls. solitary, campanulate: fr. scarlet. Brit. Columb. to Ore.—*G. pyroloides*, Hook. f. & Thom. (G. pyrolæfolia, Hook. f.). Low shrub, sometimes procumbent, almost glabrous: lvs. elliptic-obovate, about 1½ in. long: racemes few-fld., axillary. Himal., Japan.

ALFRED REHDER.

GAÙRA (Greek, *superb*). *Onagràceæ*. This includes several herbs which are distinct in appearance, but scarcely possess general garden value, though they are pleasant incidents in the hardy border of those who like native plants. The bloom ascends the slender racemes too slowly to make the plants as showy as possible. The best kind is *G. Lindheimeri*, which has white fls. of singular appearance, with rosy calyx tubes. Gaura is a genus of 20–25 species of annual and perennial herbs confined to the warmer regions of N. Amer.: lvs. alternate, sessile or stalked, entire, dentate, or sinuate: fls. white or rose, in spikes or racemes; calyx tube deciduous, obconical, much prolonged beyond the ovary, with 4 reflexed lobes; petals clawed; stamens mostly 8, with a small scale-like appendage before the base of each filament; stigma 4-lobed, surrounded by a ring or cup-like border: fr. nut-like, 3–4-ribbed, finally 1-celled, and 1–4-seeded. Gauras are easily prop. by seed. They prefer light soils, and the seedlings can be transplanted directly into permanent quarters.

A. *Height 3 ft.: fls. white.*

Lindheimeri, Engelm. & Gray. Lvs. lanceolate, with a few wavy teeth and recurved margins. Tex. G.W.F. 23. R.H. 1851:41, and 1857, p. 262.

A. *Height 1 ft.: fls. rosy, turning to scarlet.*

coccinea, Nutt. Lvs. numerous, lanceolate to linear, repand-denticulate or entire: fls. in spikes: fr. 4-sided. Tex.

W. M.

GAYLUSSÀCIA (after J. L. Gaylussac, eminent French chemist; died 1850). Syn., *Adnària*. *Ericàceæ*, tribe *Vaccinieæ*. Evergreen or deciduous shrubs with alternate, short-petioled, entire or serrate lvs., white, red, or reddish green fls. in lateral racemes, and blue or black mostly edible fruits. The deciduous species are hardy North, but are of little decorative value, while the evergreen species, all, except the half-hardy *G. brachycera*, inhabitants of the S. American mountains, are often very ornamental in foliage and fls., but tender and hardly cultivated in this country. They grow best in peaty or sandy soil and shaded situations. Prop. by seeds, layers or division; the evergreen species by cuttings of half-ripened wood under glass. See also *Vaccinium* for cult. About 40 species in N. and S. America, closely allied to Vaccinium, distinguished by the 10-celled ovary, each cell with one ovule.

A. *Lvs. evergreen, obtusely serrate.*

brachýcera, Gray. Low shrub, with creeping and ascending stem and spreading angled glabrous branches: lvs. oval, glabrous, ½–1 in. long: racemes short, with few white or pinkish fls.: fr. black. May, June. Pa. to Va. B.M. 928. L.B.C. 7:648 (as *Vaccinium buxifolium*).

AA. *Lvs. deciduous, entire.*

B. *Fls. in loose racemes: corolla campanulate.*

dumòsa, Torr. & Gray. Shrub, to 2 ft., with creeping stem and almost erect, somewhat hairy and glandular branches: lvs. obovate-oblong to oblanceolate, mucronate, shining above, leathery, 1–2 in. long: fls. white or pinkish; bracts foliaceous and persistent: fr. black, usually pubescent, rather insipid. May, June. Newfoundland to Fla. and La. B.M. 1106 (as Vaccinium).

frondòsa, Torr. & Gray. BLUE HUCKLEBERRY. DANGLEBERRY. TANGLEBERRY. Shrub, to 6 ft., with spreading, usually glabrous branches: lvs. oblong or oval-obovate, obtuse or emarginate, pale green above, whitish beneath, membranaceous, 1–2 in. long: fls. slender-pedicelled; corolla broadly campanulate, greenish purple: fr. blue, with glaucous bloom, sweet. May, June. N. H. to Fla., west to Ky., preferring moist, peaty soil. Em. 2:451. G.C. III. 7:580.

ursina, Torr. & Gray. Shrub, to 4 ft., with somewhat pubescent, spreading branches: lvs. obovate to oblong, acuminate, membranaceous, 2–4 in. long: fls. white or pinkish: fr. finally black, insipid. May, June. N. and S. Carolina. Harlan P. Kelsey writes of this species: "Shrub 2–6 ft. high; very local in a few counties in southwestern North Carolina, though common in these stations. Locally it is known as 'Buckberry,' a name given by the native mountaineers from the fact that deer feed on the very abundant clustered fruit in late summer. The berries are much used for pies and jams, and have a most peculiar and pleasant acid flavor, unlike any other Vaccinium. It promises to be a valuable addition to our garden fruits."

BB. *Fls. in short, sessile racemes: corolla ovate.*

resinòsa, Torr. & Gray. Erect shrub, to 3 ft., resinous when young: lvs. oval or oblong-lanceolate, mucronulate, yellowish green above, pale beneath, 1–1⅓ in. long: fls. short-pedicelled, nodding, reddish: fr. black, rarely white, sweet. May, June. Newfoundland to Ga., west to Wis. and Ky., preferring sandy or rocky soil. Em. 451. B.M. 1288 (as Vaccinium).

G. Pseudo-Vaccinium, Cham. & Schlecht. Evergreen, usually glabrous shrub, to 3 ft., with elliptic, entire lvs. and red fls. in secund, many-fld. racemes. Brazil. B.R. 30:62. R.H. 1845:285.

ALFRED REHDER.

GAZÀNIA (after Theodore of Gaza, 1393–1478, translator of Aristotle and Theophrastus). *Compósitæ*. This group contains some of the finest of the subshrubby composites from the Cape of Good Hope. They have an astonishing range of color,—pure white, yellow, orange, scarlet, and the backs of the rays are in some cases rich purple, and even azure-blue. Their foliage is often densely woolly beneath, and the range of form is amazing. Speaking of *G. uniflora*, Harvey says: "Frequently all the lvs. are quite simple; in other specimens some lvs. are deeply 3-lobed, the rest simple, and in our var. *pinnata*, which grows intermixed with the other varieties, the upper lvs. are quite simple, the lower either 3-lobed or pinnately 5–7-lobed, all on the same branch!" The group is also remarkable for the spots near the base of the rays of *G. Pavonia* and some others. These markings suggest the eyes of a peacock's tail. The plants are also remarkable for their behavior at night, when they close their fls. and turn their foliage enough to make the woolly under sides of the lvs. more conspicuous. The genus has 24–30 species, which are herbaceous, mostly perennial, rarely annual, with short stems or none: lvs. crowded at the crown of the root, or scattered along the stem: involucral scales in 2 or several rows, cup-like at the base: akenes wingless, villous: pappus in 2 series of very delicate, scarious, toothed scales, often hidden in the wool of the akene. Harvey in Flora Capensis 3:471. N. E. Brown in Gn. 47, p. 288.

Gazanias are now rarely met with in some of the oldest-fashioned florists' establishments. Few of the more prominent firms keep them now, and they may be said to be practically out of cultivation in America. All the kinds described below are old garden favorites abroad, particularly *G. rigens*, a common bedding plant, cult. for nearly a century and a half, but whose precise habitat has never been ascertained. Importers are urged to procure (from the Cape if necessary) the other kinds recommended by Brown, at least the perennial sorts, which are *G. jurineæfolia, subulata, longiscapa, uniflora*, var. *leucolæna* (exceptionally woolly on both sides of the lvs.), *rigens*, var. *purpurea, armerioides* and *cæspitosa*. These are presumably equally desirable with the older sorts, though not necessarily of the same ease of culture. *G. montàna*, Spreng., a new species, may be expected in American trade in 1900. It has yellow fls., and is figured in Gt. 48, p. 584. Of the annual kinds Brown recommends *G. Burchellia, Lichtensteini* and *tenuifolia*. Gasanias are amongst the most conspicuous and characteristic of the subshrubby composites at the Cape, being brilliant objects in the sandy wastes. They are said to be of easy culture in our cool greenhouses, and are commended for summer use in the borders of those who can keep them under glass in winter. They can be rapidly prop. in midsummer by cuttings made from the side shoots near the base and placed in a close frame.

A. *Color of heads yellow.*

B. *Rays not spotted: heads 2 in. across.*

uniflòra, Sims. Stems spreading 6–12 in. or more from a center: lvs. varying as mentioned above. The woolliness also varies greatly: sometimes the whole plant is snowy white; sometimes the whiteness is confined to the under sides of the lvs. B.M. 2270. L.B.C. 8:795.—The involucre is woolly, according to Harvey, but the pictures cited do not show it. This and *G. rigens* have short stems, with branches alternately leafy, while *G. vinnata, Pavonia* and *pygmæa* have little or no stem, and the lvs. radical or tufted at the ends of the short branches.

BB. *Rays spotted at base: heads 3 in. or more across.*

pinnàta, Less. Lvs. commonly pinnate (some simple); lobes oblong or linear in several pairs: peduncle longer than lvs.: involucral scales acuminate, particularly the inner ones. Harvey names 6 botanical varieties.

AA. *Color of heads orange: rays spotted at base: heads 3 in. or more across.*

B. *Lvs. mostly entire and spatulate.*

C. *Basal markings containing brown.*

rigens, R. Br. Stems short and densely leafy or diffuse, laxly leafy, with ascending branches: lvs. sometimes sparingly pinnatifid, i. e., with only 1 or 2 side lobes. B.M. 90 shows a head of scarlet rays, with basal markings of brown, black and white.

CC. *Basal markings without brown.*

spléndens, Hort. Fig. 895. Hybrid, said to resemble *G. uniflora* in habit but dwarfer and more compact. Of the kinds in common cult. it is nearest to *G. Pavonia* in coloring of fls.

BB. *Lvs. mostly pinnate.*

Pavònia, R. Br. PEACOCK GAZANIA. B.R. 1:35 shows markings of brown, white, yellow and blue, which are marvelous in design and precision of execution. Involucral scales short, the inner broad, acute or subacute.

895. Gazania splendens (× ⅙).

AAA. *Color of heads white above.*

pygmæa, Sond. Lvs. spatulate, entire. Rays white, striped purple beneath. Gn. 47:1011. I.H. 43:53. B.M. 7455. Var. **maculàta,** N.E. Br. Rays pale creamy white, with a blackish spot at the base, reverse striped dull purple. Var. **supérba,** N. E. Br. Rays white, unspotted, reverse striped bluish. This species is very unreasonable about its involucral scales, which may be short or long, sometimes cup-shaped at the base, and again almost free. This upsets one of the most important features of Harvey's key. W. M.

GEAN. *Prunus Avium.*

GEIGER TREE. *Cordia Sebestena*

GEISSORHÌZA (Greek words alluding to the coats of the bulb, which cover it somewhat like overlapping tiles). *Iridàceae.* About 30 species of Ixia-like, half-hardy Cape bulbs, which are dormant from Aug. to Nov., and are usually flowered under glass in spring and early summer. The spathe-valves are all green and membranous at the tip, while in Ixia the outer spathe-valve is short, brown and notched at the tip. The genus has a wide range in habit and in color of fls., but these plants are presumably inferior to Ixias for general culture. The following species is advertised in some of the Dutch bulb catalogues that are printed in English. Latest monograph by Baker in Flora Capensis 6:65–76 (1896–97).

Rochénsis, Ker. Lvs. glabrous, basal ones narrow, few-ribbed: stem-sheath loose and swelling: fls. 1–2 in. across; perianth tube shorter than the spathe; segments with a nectary at the base. B.M. 598 (not 672, as stated in Index Kewensis), where the whole plant is a trifle over 3 in. high and the fls. purple, with a dark red eye, the latter surrounded by a pale blue circle.

GELSÉMIUM (from an Italian name of the true Jessamine, which belongs to a different order). *Loganiàceæ.* A genus of only 2 species, the typical one being the Carolina Yellow Jessamine, our native woody twiner of the South, which climbs on trees and bears shining evergreen foliage and a profusion of axillary clusters of bright yellow, very fragrant, handsome fls., 1 in. or more long, in early spring. Lvs. opposite, membranous, the leaf-stalks joined by a transverse stipular line: calyx 5-parted; corolla open funnel-shaped, the 5 lobes broad and imbricated in the bud; stamens 5; anthers arrow-shaped; style slender; stigmas 2, each 2-parted, lobes linear: ovary 2-celled: pod oval, flattened contrary to the partition, 2-valved, many-seeded: seeds winged. The cymes of the Chinese species are terminal and trichotomous, of ours axillary, 1–3-fld. Reasoner considers ours one of the best of southern vines, and says: "Not cult. to the extent it deserves. Will grow on any land, rich or poor, wet or dry. Quick-growing, and for several weeks in spring literally covered with its lovely fragrant yellow flowers." It is somewhat grown for winter bloom in northern conservatories. Preparations of the rhizome and roots are common in drug stores. Properties nervine, antispasmodic, sedative.

sempérvirens, Ait. St. purplish: lvs. small, lanceolate or ovate, acute or subcordate at the base, short-petioled. Mar., Apr. Margins of swamps and rivers. Va. to Fla. A double-fld. form is advertised. W. M.

GENÌPA (Brasilian name). *Rubiàceæ.* This includes a West Indian shrub allied to the Cape Jasmine and barely known to American horticulture. Genipa and Gardenia are hard to separate. Small trees: lvs. with short or no stalks, opposite, large, leathery, obovate or lanceolate, shining: cymes axillary, few-fld.: fls. white to yellowish; calyx limb bell-shaped, truncated, or 5-toothed; corolla salver-shaped, limb twisted to the left, 5-parted; stigma club-shaped or bifid: ovary 1-celled: placentas 2, almost touching each other in the axis: berries edible.

clusiifòlia, Griseb. Shrub on maritime rocks of Cuba, etc.: lvs. 4 in. or less long, black when dried, obovate, glabrous: corymbs short-peduncled: calyx limb 5-cut: corolla glabrous: berry ovoid.

GENÌSTA (ancient Latin name). *Leguminòsæ.* Ornamental low shrubs with small deciduous or half evergreen lvs., showy yellow fls., generally in terminal racemes or clusters, appearing profusely in spring or summer, and followed by small, insignificant pods. None of the species is quite hardy North, but *G. tinctoria, Anglica, Germanica* and some other European species will do well in a sheltered position or if somewhat protected during the winter, while the others are more suited for cult. in southern regions. They are well adapted for covering dry, sandy banks and rocky slopes, and for borders and rockeries. They grow in any well-drained soil, and like a sunny position. Prop. by seeds, sown in spring, also by layers and by greenwood cuttings under glass. About 80 species in Europe, Canar., N. Afr., W. Asia. Allied to Cytisus, but without callose appendage at the base of the seeds: branches usually striped, sometimes spiny: lvs. entire, alternate, rarely opposite, simple, sometimes 3-foliolate: fls. yellow, rarely white, style hardly curved; calyx 2-lipped, with the upper lip deeply 2-parted. The Genista of florists is Cytisus.

A. *Color of fls. white.*

monospérma, Lam. (*Retàma monospérma,* Boiss.). Shrub, to 10 ft., with slender grayish branches, almost leafless: lvs. small, simple or rarely 3-foliolate, generally linear or linear-spatulate, silky: fls. white, fragrant, in short lateral racemes; corolla silky; calyx purple: pod broadly oval, 1-2-seeded. Feb.-April. Spain, N. Afr. B.M. 683.

896. Dyer's Greenweed—Genista tinctoria. (× ⅛.)

AA. *Color of fls. yellow.*

B. *Twigs striped, not winged.*

C. *Pod globular, indehiscent, 1-seeded.*

sphærocárpa, Lam. Similar to the former, but lower and less silky, almost leafless: fls. yellow, very small, in numerous panicled racemes; corolla glabrous. May, June. Spain, N. Afr.

CC. *Pod oval to linear, dehiscent.*

D. *Branches almost leafless at flowering season or lvs. very small and scarce.*

E. *Fls. in terminal heads, sessile.*

umbellàta, Poir. Erect shrub, to 2 feet, with rigid branches, forming a dense bush: lvs. simple or 3-foliolate, lanceolate or linear-lanceolate, silky, ¼-⅓ in. long: corolla silky, over ⅓ in. long: pod linear-oblong, tomentose, 2-5-seeded. April, May. Spain.

EE. *Fls. in racemes, pedicelled.*

ephedroides, DC. Erect shrub, to 3 ft., with rigid branches: lvs. sessile, simple or 3-foliolate, linear, almost glabrous: fls. in many-fld. terminal racemes, small; standard much shorter than keel: pod oval, 1-seeded, silky. April, May. Sardinia, Corsica.

Ætnénsis, DC. Shrub, to 6 ft., with slender branches: lvs. simple, small, linear, silky: fls. axillary, forming loose, terminal racemes, fragrant; keel shorter than the standard: pod glabrous at maturity, oblique-oval, 1-2-seeded. June, July. Sicily, Sardinia. B.M. 2674.

DD. *Branches leafy, with conspicuous lvs. (only G. virgata sometimes scarcely leafy).*

E. *Spiny.*

fèrox, Poir. Erect shrub, to 6 ft., with many stout spines: lvs. simple, rarely 3-foliolate, oblong to obovate, almost glabrous: fls. in numerous terminal racemes along the branches; corolla glabrous, over ½ in. long, fragrant: pod linear, densely silky, many-seeded. Spring. N. Africa. B.R. 5:368.

Germánica, Linn. Erect or ascending spiny shrub, to 2 ft., with villous branches: lvs. elliptic-oblong, ciliate: fls. small, in 1-2 in. long racemes: pod oval, villous, few-seeded. June, July. M. and S. Europe.

EE. *Not spiny: lvs. always simple.*

F. *Fls. in racemes: erect shrubs.*

G. *Frt. villous or silky, 1-4-seeded.*

virgàta, Link. (*Spártium virgàtum*, L'Hér.). Shrub, to 8 ft., with slender branches: lvs. lanceolate to elliptic, silky-villous, ¼-½ in. long: fls. in numerous short, 3-6-fld. racemes; standard and keel silky: pod oblong, 1-3-seeded, villous. May, July. Madeira. B.M. 2265.

flórida, Linn. Erect shrub, to 6 ft., with glabrous striped branches: lvs. spatulate-oblong or lanceolate, silky beneath, ⅓-⅔ in. long: fls. in dense, many-fld. racemes; corolla glabrous: pod oblong or narrow-oblong, silky, 2-4-seeded. April-July. Spain.

GG. *Frt. glabrous or nearly so, 3-10-seeded.*

polygalæfòlia, DC. Erect shrub, to 6 ft., with somewhat silky branches: lvs. spatulate-oblong, glabrous above, sparingly silky beneath, ½-⅔ in. long: fls. in many-fld. slender racemes; standard and wings glabrous, keel silky: pod oblong or narrow-oblong, almost glabrous, 3-6-seeded. May-July. Spain.

tinctòria, Linn. DYER'S GREENWEED. Fig. 896. Erect shrub, to 3 ft., with striped, glabrous or slightly pubescent branches: lvs. oblong-elliptic or oblong-lanceolate, almost glabrous, ciliate, ½-1 in. long: racemes many-fld., panicled at the ends of branches: corolla glabrous: pod narrow-oblong, glabrous or slightly pubescent, 6-10-seeded. June-Aug. Europe, W. Asia: naturalized in some places E. B.B. 2:271.

Var. **plèna**, Hort. With double fls. Var. **virgàta**, Mert. & Koch (*G. virgàta*, Willd., not Link, not Lam. *G. elàta*, Wender.). Of more vigorous growth, to 6 ft. high: pod 3-6-seeded. Southeast Eu.

FF. *Fls. axillary: dwarf, procumbent shrub.*

pilòsa, Linn. Dwarf, procumbent or ascending: lvs. cuneate, oblong or obovate, dark green and almost glabrous above, silky beneath: fls. axillary, 1-2, often racemose toward the end of branches: pod linear, silky, 5-8-seeded. May, June. M. and S. Eu., W. Asia.

BB. *Twigs broadly 2-winged.*

sagittàlis, Linn. (*Cýtisus sagittàlis*, Mert. & Koch). Dwarf, procumbent, with ascending or erect, mostly simple branches: lvs. ovate to oblong, villous: fls. in terminal, short racemes; corolla glabrous: pod linear-oblong, silky. May, June. Eu., W. Asia.

G. álba, Lam.=Cytisus albus.—*G. Andreàna*, Puissant=Cytisus scoparius, var. Andreanus.—*G. Anglica*, Linn. Spiny shrub, to 3 ft., sometimes procumbent, glabrous: lvs. oval to linear-oblong, bluish green: racemes few-fld. M. Europe.—*G. Anxántica*, Ten. Allied to G. tinctoria. Dwarf, diffuse: lvs. elliptic, obtuse, glabrous: fls. in racemes. Italy. S.B.F.G. 2:266.—*G. aspalathoìdes*, Lam. Low, spiny shrub: lvs. simple or 3-foliolate: fls. 1-3, axillary, forming loose, terminal racemes: pod many-seeded. N. Africa.—*G. Canariénsis*, Linn.=Cytisus Canariensis.—*G. cándicans*, Linn.=Cytisus candicans.—*G. elàta*, Wender.=G. tinctoria, var. virgata.—*G. Hispánica*, Linn. Allied to G. Germanica. Dwarf, silky: fls. in head-like, short racemes. Hardy in western N. Y., flowering after the middle of May. A spiny plant with oblong lvs. L.B.C. 18:1738. R.H. 1888:36.—*G. júncea*, Lam.=Spartium junceum.—*G. Maderénsis*, Wbb.=Cytisus Maderensis.—*G. ovàta*, Waldst. & Kit. Allied to G. tinctoria. To 1 ft., with ascending or erect branches: lvs. ovate to lanceolate, villous: pod villous. S. E. Eu. L. B. C. 5:482.—*G. polygalæfòlia*, Hort., not DC.=G. tinctoria.—*G. prostràta*, Lam.=Cytisus decumbens.—*G. racemòsa*, Hort.=Cytisus racemosus.—*G. radiàta*, Scop. Erect shrub, with opposite rigid branches: lvs. simple or 3-foliolate: fls. in 3-6-fld. heads: pod oval, silky. S. E. Europe. B. M. 2260.—*G. Retàma*, Nichols.=G. monosperma.—*G. scariòsa*, Viv.=G. triangularis.—*G. scopària*, Lam.=Cytisus scoparius.—*G. Sibírica*, Hort., not Linn.=G. tinctoria.—*G. triangulàris*, Willd. Dwarf, with ascending or procumbent triangular branches, glabrous: lvs. obovate to lanceolate, with transparent margin: fls. in short racemes. Italy, S. E. Eu. L. B. C. 12:1135 (as G. scariosa).—*G. virgàta*, Willd., not Lam., not Link, nor DC.=G. tinctoria, var. virgata.

ALFRED REHDER.

GENTIÀNA (after Gentius, king of Illyricum, who is said to have discovered the tonic value of these plants). *Gentianàceæ*. Gentians are amongst the most desirable of alpine plants, and of blue flowers in general, but they are generally considered difficult to establish. The genus is the largest in the order, and from a garden point of view the most important. About 180 species, widely scattered in temperate and mountainous regions. Chiefly perennial herbs, rarely annual or biennial, often dwarf, diffuse or tufted, sometimes erect and slender, or even tall and stout: lvs. opposite, mostly sessile: fls. blue, violet, purple, rarely dull yellow or white; floral parts typically 5, rarely 4-7.

The Blue Gentian, celebrated by tourists in the Alps, is probably mostly the stemless Gentian, *G. acaulis*. This was brought to English gardens so long ago that all record of its introduction is lost. It is by far the most popular kind in cultivation. This species is by some split into 5 distinct species, of which *G. angustifolia* of Villars (not Michaux) is nearest to the Gentianella of English gardens. It has been so much modified in cultivation that it now has stems 4-6 inches high, and the rootstock is so stoloniferous that the plant has to be cut back every year when used for edgings in English gardens. In France it is easily grown in a compost of one-half humus or leaf-soil and one-half good vegetable mold, to which may be added a little sand. Correvon writes: "It can be multiplied by means of offsets, but it is infinitely better to raise it from seed, and, in doing this, it should not be forgotten that the seeds of this group of Gentians are very tedious, and, more especially, very capricious in germinating. I have sown seeds of *G. acaulis*, some of which did not germinate for 12 months, while others (which I must say were more recently gathered) germinated in a few weeks. The seedlings should be potted as soon as possible and while they are very young. They will begin to flower in about 3 years from the time of sowing, rarely sooner." Except *G. Andrewsii*, *G. Saponaria* and *G. puberula*, and perhaps a few others, Gentians do not thrive as well in America as in England. Our seasons are too hot and dry. Whenever possible, give a damp atmosphere.

It is rash to generalize on Gentian culture, because some plants are tall, others dwarf, some found on mountains, others in lowlands, some in moist soil, others in dry lands, while some like limestone and others cannot endure it. The annual kinds are of interest only to the expert. Alpine plants in general are unique in requiring an extremely large water supply, combined with extremely good drainage. Another difficult problem is to keep the plants as cool as they are on the mountains without shading them more than nature does. Gentian seeds are small, and in germination slow and uncertain. They should be sown as soon as gathered, for the thorough drying out of small seeds is, as a rule, soon fatal. Gentians are difficult to establish, and dislike division of the root, but are well worth patient years of trial, for they are very permanent when once established. Nature-like alpine gardens are one of the latest and most refined departments of gardening, and Gentians are one of the most inviting groups of plants to the skilled amateur. Consult *Alpine Gardens*.

There are several Fringed Gentians, but ours (*G. crinita*, Fig. 897) is perhaps the most beautiful of Gentians, and one of the choicest and most delicate of American wild flowers. It has been proposed as our national flower, and, while sought after less than the trailing arbutus, it is in even greater danger of extermination in certain states because it is a biennial, and because it has never been successfully cultivated. Seeds of *G. crinita* have long been advertised by one American dealer, but at the Cornell Experiment Station these have never been germinated. The Fringed Gentian is, however, firmly rooted in American literature, and from the time of Bryant's ode many tributes in verse have been paid to its unique beauty. The daily unfolding of its square-ridged and twisted buds has been watched in thousands of homes. By the artists its blue is often considered the nearest approach to the color of the sky, but it must be confessed that a shade of purple often appears in the older flowers.

The Gentian enthusiast should hasten to procure a copy of "The Garden" for Aug. 24, 1895, which contains Correvon's fine cultural monograph of Gentians translated from R.H. 1893, p. 525, and 1894, p. 42. Correvon cultivates his Gentians at Geneva, Switzerland. The writer of the present article has searched Correvon's monograph for facts concerning season of bloom, habitat and cultural directions, which are scattered below.

Correvon makes 4 cultural groups of Gentians:

I. *Tall Gentians for general culture:* species whose roots are more or less stout, which are of relatively easy culture, and therefore suitable for borders, rockwork and landscape gardening. Typical plant, *G. lutea;* others are *G. affinis, alba, Andrewsii, asclepiadea, Bigelovii, Burseri, Cruciata, decumbens, Fetisowi, gelida, Kesselringi, macrophylla, Olivieri, Pneumonanthe, Porphyrio, Saponaria, sceptrum, septemfida* and *Walujewi*.

II. *Low-growing Gentians:* species whose roots being less stout are adapted to rockwork, and for the open ground only when a special compost is provided. Includes *G. acaulis* and the species into which it is sometimes divided.

III. *Tufted Gentians:* species with sessile flowers growing little above the level of the ground, and suited for the same positions as Group II. Typical plant, *G. verna:* others are *G. Bavarica, imbricata, Oregana, ornata, Pyrenaica*, and *pumila*.

IV. *Rare Gentians:* species which cannot be grown without some special knowledge and practical experience. Typical plant, *G. purpurea;* others are *G. ciliata, Frœlichii, punctata*, and presumably all the rest.

The two most popular Gentians in American cultivation seem to be *G. acaulis* and *Andrewsii*. These are, perhaps, followed by *G. Cruciata, puberula* and *Saponaria*. The plant which King Gentius knew is probably *G. lutea*, the root of which furnishes the Gentian of drug stores. From the same sources comes the liqueur or cordial called "Gentiane."

Index of names: those marked with an asterisk (*) appear in American trade catalogues; the rest are cult. abroad. The plants are perennials and mountain-loving, unless otherwise stated.

*acaulis, 51.
adscendens, 3.
affinis, 29.
*alba, 7.
algida, 10 and 11.
alpina, 55.
*Andrewsii, 22.
angulosa, 48.
*angustifolia, 52 and 31.
*asclepiadea, 19.
barbata, 16.
Bavarica, 49.
*Bigelovii, 39.
Burseri, 2.
*calycosa, 35.
campestris, 12.
Carpatica, 46.
Catesbœi, 21 and 22.
ciliata, 15.
*Clusii, 54.
cordifolia, 28.
*crinita, 14.
*Cruciata, 45.
Dinarica, 56.
*decumbens, 3.
detonsa, 16.
Fortuni, 27.
frigida, 9, 10.
Frœlichii, 18.
Gaudini, 43.
gelida, 11.
imbricata, 47.
incarnata, 8.
intermedia, 8.
Kochiana, 53.
Kurroo, 37.
*linearis, 23.
*lutea, 1.
*macrophylla, 44.
Moorcroftiana, 13.
*Newberryi, 38.
ochroleuca, 8.
Olivieri, 30.
*Oregana, 40.
ornata, 32.
Pannonica, 42.
*Parryi, 36.
Pneumonanthe, 20.
Porphyrio, 31.
pseudo - Pneumonanthe, 23.
prostrata, 25.
*puberula, 41.
pumila, 50.
*punctata, 6.
*purpurea, 4.
Pyrenaica, 24.
quinqueflora, 17.
*quinquefolia, 17.
rubra, 5.
*Saponaria, 21.
*scabra, 26.
*sceptrum, 34.
*septemfida, 28.
serrata, 16.
Thomasii, 4.
triflora, 33.
verna, 48.

A. *Calyx spathe-like, split in two.*

B. *Color of fls. yellowish.*

C. *Form of corolla wheel-shaped*... 1. **lutea**

CC. *Form of corolla club-shaped, at least in bud*.................. 2. **Burseri**

BB. *Color of fls. blue or purple, at least above.*

C. *Corolla plaited*................ 3. **decumbens**

CC. *Corolla not plaited.*

D. *Anthers grown together*........ 4. **purpurea**

DD. *Anthers free*.................. 5. **rubra**

AA. *Calyx with a tubular portion, and usually 5 lobes.*

B. *Color of fls. yellowish, or greenish white.*

C. *Style distinct: capsule not stalked*...................... 6. **punctata**

CC. *Style none or very short: capsule stalked.*

D. *Height 2 ft*.................... 7. **alba**

DD. *Height 9–12 in*................. 8. **ochroleuca**

DDD. *Height 6 in. or less.*

E. *Lobes of calyx longer than the calyx tube*................... 9. **frigida**

EE. *Lobes of calyx shorter than the calyx tube.*

F. *Lvs. lanceolate-linear*........10. **algida**

FF. *Lvs. ovate-lanceolate*.........11. **gelida**

BB. *Color of fls. blue or purple.*

C. *Corolla not plaited.*

D. *Glands found at the base of the filaments.*

E. *Calyx 4-cut*...................12. **campestris**

EE. *Calyx 5-cut*...................13. **Moorcroftiana**

DD. *Glands not found at the base of the filaments.*

E. *Fringed Gentians: calyx 4-cut.*

F. *Capsule raised on a distinct stalk.*

G. *Apex of lobes fringed, the sides less so*...............14. **crinita**

GG. *Apex of lobes not fringed, base fringed*...............15. **ciliata**

FF. *Capsule on a very short stalk*.16. **serrata**

EE. *Not fringed: calyx 5-cut: corolla lobes tipped with a sharp point* ....17. **quinquefolia**
OO. *Corolla plaited.*
D. *Stigmas 2, always distinct.*
E. *Capsules finally raised on a distinct stalk.*
F. *Anthers permanently grown together.*
G. *Calyx as long as the corolla*.18. **Frœlichii**
GG. *Calyx one-half or one-third as long as the corolla.*
H. *Seeds not at all winged*.....19. **asclepiadea**
HH. *Seeds slightly winged.*
I. *Fls. open* ....20. **Pneumonanthe**
II. *Fls. closed, blue*...........21. **Saponaria**
HHH. *Seeds strongly winged.*
I. *Fls. closed, purple*.........22. **Andrewsii**
II. *Fls. open*..................23. **linearis**
FF. *Anthers free, at least finally.*
G. *Number of corolla lobes 10*..24. **Pyrenaica**
GG. *Number of corolla lobes 5 (rarely 4).*
H. *Calyx 4-lobed* ....25. **prostrata**
HH. *Calyx 5-lobed.*
I. *Lvs. distinctly rough above (hispid-scabrous)* ....26. **scabra**
II. *Lvs. distinctly rough at the margins (scabrous).*
J. *Lobes of calyx shorter than the calyx tube*...........27. **Fortuni**
JJ. *Lobes of calyx as long as the calyx tube.*
K. *Corolla lobes ovate, acute, a little longer than the much cut appendages*...28. **septemfida**
KK. *Corolla lobes oblong-lanceolate, obtuse, thrice as long as the much cut appendages*...............29. **affinis**
III. *Lvs. not distinctly rough above or at margins.*
J. *Seeds not at all winged.*
K. *Form of corolla lobes linear-oblong* ....30. **Olivieri**
KK. *Form of corolla lobes ovate, often broadly so.*
L. *Fls. solitary.*
M. *Peduncled* ....31. **Porphyrio**
MM. *Not peduncled*.........32. **ornata**
LL. *Fls. in clusters of 3–5 or more.*
M. *Lvs. lanceolate-linear*..33. **triflora**
MM. *Lvs. ovate to oblong-lanceolate.*
N. *Height 2–4 ft*..........34. **sceptrum**
NN. *Height 9–12 in.*
O. *Calyx lobes ovate, about as long as the calyx tube* ....35. **calycosa**
OO. *Calyx lobes linear, moderately or much shorter than the calyx tube* ....36. **Parryi**
JJ. *Seeds winged (at the base in Kurroo; in Bigelovii wings narrow, thickish).*
K. *Height 2–8 in.: fls. spotted.*
L. *Pedicel ½ in. long or more*..................37. **Kurroo**
LL. *Pedicel very short, practically absent* ....38. **Newberryi**
KK. *Height 1–2 ft.*
L. *Fls. in a dense spike*....39. **Bigelovii**
LL. *Fls. 1–few or several.*
M. *Appendages conspicuous, sometimes nearly as long as the corolla lobes*.................40. **Oregana**
MM. *Appendages only half as long as the corolla lobes* ....41. **puberula**

EE. *Capsule sessile.*
F. *Anthers grown together: style distinct: seeds winged.*
G. *Calyx 5-cut, the lobes longer than the calyx tube*.........42. **Pannonica**
GG. *Calyx entire, truncate, indistinctly 5-lobed*..............43. **Gaudini**
FF. *Anthers free: style usually not distinct: seeds not winged.*
G. *Lvs. 6–12 in. long: calyx 5–6-lobed*.......................44. **macrophylla**
GG. *Lvs. much shorter: calyx 4-lobed*.......................45. **Cruciata**
DD. *Stigmas contiguous, rather funnel-shaped, the margin crenate-fimbriate.*
E. *Anthers free: style distinct.*
F. *Calyx pellucid, veiny.*
FF. *Calyx leafy*..................46. **Carpatica**
G. *Seeds winged*...............47. **imbricata**
GG. *Seeds not winged.*
H. *Lvs. ovate*..................48. **verna**
HH. *Lvs. obovate*................49. **Bavarica**
HHH. *Lvs. linear*.................50. **pumila**
EE. *Anthers connate: style short*..51. **acaulis**
F. *Fls. spotted.*
G. *Color sky-blue*..............52. **angustifolia**
GG. *Color violet-blue*............53. **Kochiana**
FF. *Fls. not spotted.*
G. *Corolla broadly bell-shaped.*
H. *Size of fls. large*...........54. **Clusii**
HH. *Size of fls. small*...........55. **alpina**
GG. *Corolla almost cylindrical*..56. **Dinarica**

1. **lùtea,** Linn. Fls. in dense, umbel-like cymes; corolla 5–6-parted; lobes oblong-linear, acuminate; anthers free; style none. July–Sept. Eu., Asia Minor.—Prop. only by seed. Sow seed in Nov. in coldframe. Seedlings appear the following March and April. In May and June prick them out under a coldframe, and in Aug. transfer young plants to pots, where they should be kept until needed for permanent outdoor use. Be very careful never to break the roots. Sometimes cult. abroad for medicine.

2. **Búrseri,** Lapeyr. Lvs. 7-nerved: corolla mostly 6-cut; lobes ovate-oblong, acute; anthers connate; style distinct. June, July. Pyrenees.—Cult. like 1.

3. **decúmbens,** Linn., f. (*G. adscéndens*, Pall.). Lvs. linear-lanceolate, margins scabrous: fls. blue; corolla narrowly obconical, toothed between the lobes; lobes 5, ovate; anthers connate, finally free. Himal., Sib. June–Aug. B.M. 705, 723.—Cult like 1.

4. **purpùrea,** Linn. Lvs. ovate-oblong, 5-nerved: fls. purple above; corolla tube yellowish, club-shaped; lobes mostly 6, obovate-subrotund, one-third the length of the tube. Aug., Sept. Eu. L.B.C. 6:583 shows a rich, dull purple, with no trace of blue.—Compost of sphagnum and heath soil. Be careful not to break the roots.

5. **rùbra,** Clairv. (*G. Thómasii*, Gillab.). One of 5 or more natural hybrids between *G. lutea* and some species of the section Cœlanthe, which includes *G. punctata*, *purpurea*, *Pannonica*, and *Burseri*: fls. purplish outside. Swiss Alps.

6. **punctàta,** Linn. Lvs. 5-nerved: calyx 5–7-cut: corolla tube bell-shaped; lobes ovate, muticous, one-third the length of the tube; anthers finally free. Middle Eu.—The spots are not arranged in any definite order. This belongs to the section Cœlanthe, in which the seed has a wing of the same color, while the next 5 species belong to the section Pneumonanthe, in which there is no wing, or it is of a different color.—Cult. like 18.

7. **álba,** Muhl. St. stout: lvs. acuminate, with a clasping base: fls. in a terminal head, with single or clustered ones in the upper axils; dull white, commonly tinged yellowish or greenish; corolla resembling *G. Saponaria*, but more bell-shaped and open; lobes ovate, short, little if at all spreading. Low grounds and mountain meadows, N. Amer. B.M. 1551, erroneously, as *G. ochroleuca*.—Cult. like 20.

8. **ochroleùca,** Frœl. St. ascending: lvs. ovate-lanceolate and obovate: fls. in crowded terminal, nearly sessile, leafy cymes; corolla yellowish white, club-shaped,

connivent at the apex. N. Amer. Not B.M. 1531 or 1551. Var. **intermèdia,** Griseb. (*G. intermèdia,* Sims, not L. B. C. 3:218), may be a hybrid between this and *G. Andrewsii.* It resembles *G. ochroleuca* in having calyx lobes of unequal lengths, but as long as or longer than the calyx tube, and free anthers: it resembles *G. Andrewsii* in the tinge of purplish blue. B.M.2303. Var. **incarnàta,** Griseb. (*G. incarnàta,* Sims). B. M. 1856 from Carolina is not cult. These forms are not considered worthy of varietal rank in Gray's Syn. Fl.

9. **frigida,** Hænk. Lvs. spatulate-linear, obtuse: fls. 1 or 2 at the top, sometimes a few in the upper axils; calyx not laterally cut, and half as long as the corolla or more; calyx teeth lanceolate, a little longer than the calyx tube; corolla club-shaped, plaits not cut. Carpathian Mts.; also N. Amer.—This is the true type of *G. frigida,* which is not in cultivation, but is inserted to make clear the differences between *G. algida* of Pallas and of Steven.

10. **álgida,** Pall., not Stev. (*G. frigida,* var. *álgida,* Griseb.). Lvs. lanceolate-linear: fls. 2–5 at the top and distinctly pedicelled; calyx laterally cut and one-third the length of the corolla; calyx teeth linear-lanceolate, hardly as long as the calyx tube and sometimes only half as long; corolla between club- and bell-shaped; plaits cut with a few crenate teeth. Altai Mts., E. Siberia, N. Am. Gn. 17, p. 343, same as Gn. 27, p. 89; 48, p. 146, and N. 2:60, Fig. 93.—This grows 4–5 in. high, has numerous stems and fls. nearly 2½ in. long, whitish, with blue spots in longitudinal lines. The writer has not seen Gt. 1006.

11. **gélida,** M. Bieb. (*G. álgida,* Stev., not Pall.). Lvs. ovate-lanceolate, 3-nerved: fls. few and terminal, or many in the upper axils, peduncled; calyx teeth linear-oblong, acute, nearly as long as the calyx tube or shorter than it; corolla rather bell-shaped, yellowish white, its lobes broadly ovate, twice as long as the calyx and twice as long as the lacerated plaits. June, July. Caucasus. Not P.M. 7:5, which is *G. septemfida,* var. *cordifolia.*—"Light, deep, cool soil and full sunlight." *Correvon.*

12. **campéstris,** Linn. Annual: fls. dark purplish blue; calyx 4-cut; corolla nearly bowl-shaped, crowned; anthers free; style none.

13. **Moorcroftiàna,** Wall. Annual, 4–10 in. high: fls. pale blue; calyx 5-cut; corolla funnel-shaped. Himal. B.M. 6727, where fls. are shown as pale purple.

14. **crinita,** Frœl. Fig. 897. FRINGED GENTIAN. Biennial: erect, branched, 1–2 ft. high: lvs. lanceolate or ovate-lanceolate, acutish, from a rounded or subcordate partly clasping base: corolla lobes wedge-obovate: seeds roughened by scales or needle-like projections. Moist woods and meadows. N. Amer. B.M. 2031. D. 275. G.W.F. 19. Mn. 4:161. B.B. 2:613.—The ribs of the calyx (made by the decurrent lobes) are one of the minor beauties of this plant, and are probably more pronounced than in the other Fringed Gentians here described.

15. **ciliàta,** Linn. Perennial: stem flexuose, scarcely branched: lvs. linear, obtuse: corolla lobes obovate-oblong: seeds smooth. Dry limestone soils. Eu. Not B.M. 639, which is *G. serrata.*—Hardly 3 per cent of Correvon's seedlings have flowered. He recommends a heavy, compact soil which is almost clayey, and full sunlight.

16. **serràta,** Gunn. (*G. barbàta,* Frœl. *G. detónsa,* Griseb. *G. detónsa,* var. *barbàta,* Griseb.). Annual: stem erect, branching, 3–18 in. high: lvs. linear or lance-linear: corolla lobes oblong or spatulate-obovate, fringed around the apex and sides or sometimes either part nearly bare. Wet lands, Ural and Altai Mts., Caucasus, N. Amer. B.B. 2:614. B.M. 639 erroneously as *G. ciliata.*—No plants appear to be advertised as *G. serrata. G. barbata* is a trade name abroad.

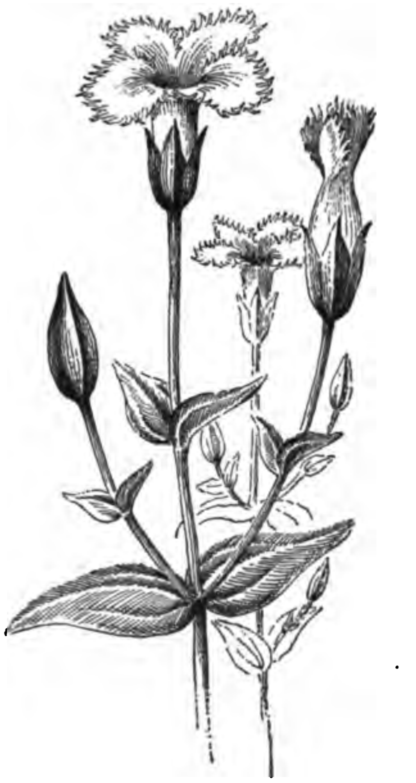
17. **quinquefòlia,** Linn. (*G. quinqueflòra,* Hill, Lamarck and others). Annual: height 1–2 ft., the larger plants branched: lvs. 3–7-nerved: inflorescence thyrsoid-paniculate: clusters 3–5-fld.: fls. bright blue; calyx one-fifth or one-fourth as long as the narrowly funnel-shaped corolla. N. Amer. Probably the form in cult. is var. **occidentàlis,** Gray. Height 2–3 ft., paniculately much branched: inflorescence more open: calyx half the length of the broader corolla. B.B. 2:615. B.M. 3496.—Very pretty.

18. **Frœlichii,** Jan. Stems short, almost tufted: fls. blue, solitary, peduncled, nearly as long as the stem: corolla not spotted. Very rare in Alps, limestone rocks.—Easily grown on rockwork in compost of equal parts of sphagnum, heath soil and vegetable mold. Half-exposure to sunlight.

19. **asclepiadèa,** Linn. Stem strict: calyx teeth very short: fls. in spike-like racemes, dark blue; corolla club-shaped; calyx one-third as long as the corolla: seeds not winged. July–Sep. S. Eu., Caucasus. B.M. 1078. Gn. 48, p. 143, and 54, p. 39.—The white-fld. form is excellent. Shade or half-shade, and moist, deep soil rich in humus.

20. **Pneumonánthe,** Linn. Stem erect: fls. dark blue in a cyme-like raceme (the top fls. opening first); corolla club-shaped; lobes ovate, acute, mucronate, much longer than the appendages. Aug.–Oct. Mountain marshes, Eu., N. Asia. Var. **guttàta,** Sims, is dotted white. B.M. 1101.—"Requires a cool, deep, spongy soil, rich in humus. Dislikes lime, and prefers sandy soil. Does remarkably well when planted on margins of ponds or brooks. Prop. by seed or division." *Correvon.*

21. **Saponària,** Linn. (*G. Càtesbæi,* Walt., not And.). BARREL OR SOAPWORT GENTIAN. Stem ascending: fls. light blue, club-shaped; calyx lobes linear or oblong, mostly as long as the calyx tube; corolla lobes short, broad, roundish, erect, little, and often not at all longer than the 2-cleft and many-toothed intervening appendages. N. Amer. B.M. 1039.—(Hooker is probably wrong in referring this picture to *G. Andrewsii,* though the calyx lobes in the plate are not narrow enough.) Cult. like 20.



897. Fringed Gentian—Gentiana crinita (× ½).

22. **Ándrewsii,** Griseb. (*G. Càtesbæi,* And., not Walt.) CLOSED, BLIND OR BOTTLE GENTIAN. Fig. 898. Stem ascending: fls. purplish blue; calyx lobes lanceolate to

ovate, usually spreading or recurved, shorter than the calyx tube; corolla lobes entirely obliterated, the teeth at the top being supposed to be the remains of the appendages often found between the corolla lobes in other species. July, Aug. Moist places, N. Amer. B. M. 6421. D. 273. B.B. 2:616. Gn. 27:477. L.B.C. 9:815 erroneously as *G. Saponaria.*—A white-fld. form is cult. For culture, see 20.

898. Closed Gentian—Gentiana Andrewsii. (× ¼.)

23. **lineàris,** Frœl. (*G. pseudo-Pneumonánthe,* Schult.). Stem strict, 1–2 ft. high: fls. blue, 1–5 in the terminal cluster; corolla narrowly funnel-shaped; lobes erect, roundish ovate, obtuse, a little longer than the triangular, acute, entire or 1–2-toothed appendages. Bogs, N. Amer. B.B. 2:617.

24. **Pyrenàica,** Linn. Stem tufted, about as long as the fl.: lvs. with a cartilaginous, scabrous margin: fls. solitary, dark blue; corolla funnel- or nearly bowl-shaped. May, June. Eu., Asia Minor. B.M. 5742.—Very distinct and dainty. Cultivated like 48.

25. **prostràta,** Hænke. Annual, dwarf: lvs. white-margined: fls. blue, solitary, the parts usually in 4's; corolla salver form, in fruit inclosing the capsule. N. Amer., Asia.

26. **scàbra,** Bunge. Stem erect, leafy: fls. dark blue, clustered; corolla bell-shaped. E. Asia. *G. Fortuni* is considered a variety by recent authorities. Var. **Buérgeri** is advertised by Yokohama Nursery Co.

27. **Fórtuni,** Hook. Lvs. rather distant, 3-nerved: terminal fls. rather clustered; corolla lobes blue, spotted white; outside of tube green; plaits blue, terminated by 3-toothed appendages, much shorter than the corolla lobes. China. B.M. 4776. F.S. 9:947. I.H. 1:36.—Now thought to be a variety of *G. scabra.*

28. **septémfida,** Pall. Lvs. lanceolate ("ovate," *Grisebach*), 3–5-nerved: fls. dark blue, in head-like cymes; calyx lobes linear; corolla club-shaped. July–Oct. N. Asia, Orient. B.M. 1229 and 1410 (both purple outside and dotted brown within; the lobes of the latter spotted white). L.B.C. 1:89. Gn. 54, p. 37. P.M. 8:51. Not F.S. 8:765.

Var. **cordifòlia,** Boiss. (*G. cordifòlia,* C. Koch), has heart-shaped lvs.: corolla tube greenish white outside, unspotted within; lobes narrower, unspotted. B.M. 6497. P.M. 7:5, erroneously as *G. gelida.*—The name septemfida is misleading, as 7-lobed corollas are very rare. Cult. like 1.

29. **affinis,** Griseb. Lower lvs. obovate-oblong; upper lvs. lanceolate, acutish: fls. dark blue, in racemiform cymes; calyx lobes oblong-linear; corolla narrowly obconical, open. Northwestern Amer. Gn. 46, p. 77, and 48, p. 139. B.B. 2:615 (where corolla lobes are pictured erect, but said to be spreading).—Cult. like 20.

30. **Olivièri,** Griseb. Fls. dark blue, in umbel-like cymes; corolla narrowly obconical; plaits triangular, nearly entire. June–Aug. Mountain pastures, Asia. By recent authority referred to *G. decumbens.*—Cult. like 1.

31. **Porphýrio,** J. F. Gmel. (*G. angustifòlia,* Michx., not Vill.). Lvs. narrowly linear: fls. blue, somewhat brown-dotted (also a snow-white variety with a greenish hue outside); corolla funnel-shaped; anthers connivent but never connected. July, Aug. Moist pine barrens, N. Amer. B.B. 2:618.—Cult. like 20.

32. **ornàta,** Wall. Lvs. broadly linear: fls. blue, streaked; calyx lobes spreading; corolla ventricose; lobes very short, spreading. Himal. B.M. 6514. G.C. II. 20:396.

33. **triflòra,** Pall. Stem erect: fls. dark blue; corolla club-shaped. E. Siberia.

34. **scéptrum,** Griseb. Lvs. oblong-lanceolate: fls. dark blue; corolla club-shaped: seeds winged on one side according to Grisebach, but Gray says not winged. Aug., Sept. N. W. Amer.—Cult. like 1, except that it requires half shade and a rather peaty soil.

35. **calycòsa,** Griseb. Lvs. ovate: fls. dark blue, commonly solitary, according to Gray; corolla oblong-funnel-shaped; appendages triangular-awl-shaped, laciniate or 2-cleft at the tip. N. W. Amer.

36. **Párryi,** Engelm. Lvs. somewhat glaucous, ovate to oblong-lanceolate: fls. purple-blue, appendages narrow, deeply 2-cleft. N. W. Amer.

37. **Kurroò,** Royle. St. tufted, as high as 7 in.: lower lvs. lanceolate, upper linear: fls. blue, spotted white inside, 1–3 on a stem; corolla bell-shaped. Himal. Gn. 17:224. B.M. 6470. Var. **brévidens** has shorter calyx lobes. J.H. III. 30:3.

38. **Néwberryi,** Gray. St. 2–4 in. high: lower lvs. obovate or spatulate: fls. pale blue, white inside, greenish dotted; corolla broadly funnel-shaped. N. W. Amer.

39. **Bigelovii,** Gray. St. 6–16 in. high, equally leafy to the summit: fls. purple; corolla more narrowly funnelform and smaller than in *G. affinis.* July, Aug. N. Mex. B.M. 6874.—"Soon forms large clumps, often with 40–50 stems from a single plant, each bearing 10–20 bright blue fls." *D. M. Andrews.*

40. **Oregàna,** Engelm. Height 1–2 ft.: lvs. ovate: fls. blue; corolla broadly funnel-shaped, over 1 in. long, lobes short, roundish. July, Aug. N. W. Amer.

41. **pubérula,** Michx. About 1 ft. high: lvs. oblong-lanceolate to lanceolate-linear: fls. blue; corolla open-funnel-shaped, 1½–2 in. long; lobes ovate. N. W. Amer. B.B. 2:615.

42. **Pannónica,** Scop. Lower lvs. broadly elliptical, 5-nerved, margin scabrous; upper ones ovate-lanceolate, 3-nerved: fls. purple above; calyx 5–7-cut; corolla leathery; anthers connate at first, finally free. Eu.

43. **Gaudíni,** Thom. Natural hybrid with the habit of *G. purpurea,* but the membranous corolla of *G. punctata:* fls. rosy violet. Eu.

44. **macrophýlla,** Pall. Lvs. lanceolate, distant, very spreading: internodes unequal: fls. dark blue. July. Aug. B.M. 1414, not L.B.C. 3:218.—Cult. like 1.

45. **Cruciàta,** Linn. (*Cruciàta verticillàta,* Gilib.). Lvs. ovate-lanceolate, crowded, erect-spreading; internodes equal: fls. dark blue. June–Aug. Eu., N. Asia.—Cult. like 1. Limestone and full sunlight.

46. **Carpática,** Kit. Lvs. obovate: fls. dark blue (as are the next 4 species); corolla funnel-shaped. Carpathian Mts.—Little known.

47. **imbricàta,** Frœl. Lvs. acute, margins scabrous, (the next 3 species with smooth margins): corolla lobes subrotund. June, July. Limestone rocks, Alps.—In this and the next 3 species, the corolla lobes are usually crenate, half the length of the tube, and 6 times the length of the plaits. "Eastern and granitic Alps." *Correvon.* Cult. like 49.

48. **vérna,** Linn. Tufted: stem angled: lvs. ovate or ovate-lanceolate: fls. solitary; calyx membranaceous; corolla nearly bowl-shaped; lobes ovate, obtuse. Apr.–June. Eu., Caucasus. B.M. 491. L.B.C. 1:62. R.H. 1859, p. 250. Gn. 48, p. 139. G.C. II. 24:373. Var. **alàta,** Griseb. (*G. angulòsa,* M. Bieb.), is taller and has the nerves of the ventricose calyx produced into wings.—Rockwork, in a compost of heath-soil, finely crushed granite, and vegetable mold, with full sunlight.

49. **Bavárica,** Linn. Calyx lobes lanceolate: corolla funnel- or nearly bowl-shaped; lobes obovate, obtuse: ovary sessile: seeds not winged. May–Aug. Cent. Eu. F.S. 7:651. L.B.C. 13:1256. J.H. III. 35:585. Gn. 15:174 (poor).—The pictures cited all show a salver-shaped corolla. "Requires a soil that is peaty, or at the very least porous and cool, well drained, and capable of retaining an abundant supply of moisture, although it may be fully exposed to the sun. In the alpine garden here we grow them in pure sphagnum moss on a wall facing due south, but the plants which we raise for sale are grown in pots in a compost of sphagnum, heath-soil and sand. Finest of Group III." *Correvon.*

50. **pùmila,** Jacq. Stem 3–4-angled: calyx lobes linear: corolla lobes ovate, acute. June, July. Tyrolese and Carinthian Alps.

51. **acaùlis,** Linn. GENTIANELLA. STEMLESS GENTIAN. By the botanists of continental Europe this is often split up into the 4 or 5 following species. The plants that Linnæus had in mind were probably mostly Clusii and Kochiana. For pictures of *G. acaulis* in its widest sense, see B.M. 52. G.C. III. 15:236. Gn. 48, p. 146, and 54, p. 39, and F.S. 23:2421, where a more detailed account of the 4 following species is given.

52. **angustifòlia,** Vill., not Michx. Stoloniferous: lvs. linear-oblong, narrowing towards the base, glistening above: fls. spotted with sprightly green; calyx lobes more or less spreading, oval, abruptly contracted at the base. May, June. Limestone rocks, Alps.—Considered by Correvon the handsomest species of the whole genus.

53. **Kochiàna,** Perr. & Song. Lvs. large, flat, thin, spreading, oval or broadly oblong, light green: calyx lobes oblong, limp, more or less contracted at the base and separated by truncate sinuses; corolla with 5 blackish green spots on the throat. May, June. Common in pastures on granitic Alps.—Dislikes lime.

54. **Clùsii,** Perr. and Song. Lvs. lanceolate-acute, leathery: fls. dark blue; calyx lobes pressed close against corolla, not contracted at base, and separated by acute sinuses. May, June. Limestone rocks, Alps.

55. **alpìna,** Vill. Stem almost wanting: lvs. small, glistening, curving inwards and imbricated, forming rosettes which incurve at about the middle: fls. dark blue. May, June. Granitic Alps.—This and *G. Kochiana* "require a compost of one-third crushed granite, one-third heath soil, and one-third vegetable loam, and should be planted on rockwork half exposed to the sun."

56. **Dinárica,** Beck. Lvs. broad, thick, erect: fls. dark blue. Alps of S. and E. Austria.

The following are trade names abroad of Gentians not sufficiently described for insertion above: *G. Arvernénsis*, Hort. Perhaps a var. of Pneumonanthe. Fls. Napoleon blue. See G. C. II. 20:40.—*G. Charpentièri*, Thom. Naturally hybrid, intermediate between lutea and punctata: corolla spotted red: calyx 5-cut. Grisebach does not say whether the corolla is not plaited, anthers always free, and style none. Alps, above Engadine.—*G. Fetisowi*, Regel. St. erect, tall: fls. deep blue. China. Gt. 1069.—*G. Hangsti*, Hausm.=G. Kummeriana.—*G. Késselringi*, Regel. Height about 8 in.: fls. whitish, dotted violet outside. Turkestan. Gt. 1087.—*G. Kummeriàna*, Sendt. Hybrid between lutea and Pannonica. Fls. yellowish.—*G. Wállichiana*. Height 8–12 in.: fls. clear blue.—*G. Walujéwi*, Regel & Schmalh. Fls. whitish, dotted pale blue. Turkestan. Gt. 1140. W. M.

GENUS, pl. **GENERA** (i. e., *kind*), is a term used in natural history to designate a group of species. As with species, so the Genus is an indefinite conception, varying with the author. The chief value of the conception is its use in aiding us conveniently to arrange and name plants and animals. The name of the Genus is the first of the two words in the name of the plant: thus, in *Brassica oleracea*, Brassica designates the Genus, and oleracea the particular Brassica of which we are speaking. It is impossible to trace the origin of the genus-conception in natural history, but it is usually ascribed to Konrad Gesner (Zurich, 1516–1565). L. H. B.

GEÒNOMA (Wittstein gives this ponderous explanation: "Greek, *geonomos*, skilled in agriculture: for this tree puts forth buds at the apex of its stem which become new trees"). *Palmàceæ*, tribe *Arèceæ*. Slender spineless palms with ringed, reed-like stems: lvs. terminal or alternate; blade entire, 2-lobed at the apex, or more or less pinnatisect; segments acuminate, 1-nerved, with the margins broadly recurved at the base; rachis acute above, convex on the back; petiole nearly cylindrical, concave at the base above; sheath tubular; spadices ascending or recurved, simple, forked or paniculately branched, slender or stout, often colored; spathes 2, often deciduous before flowering, or obsolete, the lower one partial, truncate, concave, the upper compressed or fusiform: fls. borne in the furrows of the spadix, at length partially exserted, when in 3's the upper one pistillate: cells of the anthers twisted: fr. small, globose, black. Species about 100. Tropical America. For *G. Ghiesbreghtiàna*, see *Calyptrogyne*.

JARED G. SMITH.

Several of the members of this extensive genus of small-growing palms are useful for the greenhouse, though most attractive while in a small state, from the fact that Geonomas soon begin to form a stem, and when aged become rather scantily furnished specimens. These palms are by no means difficult to grow, and do not require a very high temperature, their natural habitat being the mountains of Central and South America, some of the species being found at an altitude of over 4,000 feet above sea level. Geonomas form part of the undergrowth on their native mountains, and are said never to appear in the open country unsheltered by trees of larger growth; therefore, shade is necessary for them when cult. under glass.

The old practice of growing Geonomas in a very light, peaty soil does not seem to be the only method, for excellent results have been secured by growing them in a good loam, well manured and well drained, giving an abundance of water and a night temperature of 60°. Red spiders and thrips are the most troublesome insects to which these plants are subject, and both of these pests multiply much more rapidly if the plants are kept too warm and dry.

The most useful species from a commercial point of view is *G. Riedeliana* (*G. gracilis*), which reminds one of *Cocos Weddelliana*, but has longer leaflets. Those marked thus (*) are cult. under glass in the North; those marked thus (†) are cult. in S. Calif. only; the others are cult. indoors North and also in S. Calif., except *G. Spixiana*, which is cult. only in S. Fla. The picture of *G. Spixiana* below is adapted from Martius' work on palms.

899. Geonoma Spixiana.
A tall palm, as it grows in the tropics.

A. *Lvs. simple, 2-lobed at the apex.*

B. *Cuneate-oblanceolate, rusty, tomentose.*

Spixiàna, Mart. Fig. 899. Stem slender, solitary, 6–9 ft. high: blades 3 ft. long, bifurcate one-fourth of their length, each lobe lanceolate-acuminate, divergent. Western Brazil.

BB. *Cuneate-ovate, plicate.*

Seèmanni, Hort. Low, 1–3 ft. high: lvs. all alike, the first 2 in. long, the later ones 10 in. long, short-petioled, triangular, with broad, scarious margins: blade feather-veined Central America.

AA. *Lvs. pinnate.*

B. *Basal leaf-segments narrow; the upper ones the broadest.*

***acaùlis**, Mart. Acaulescent : lvs. long-petioled, 3–4 ft. high ; blade unequally pinnatisect, 22–25-nerved on each side ; basal segments 4 lines wide, spreading, the middle and upper erect-spreading at an acute angle, ¾–4 in. wide, the apical very wide. Central Brazil.

BB. *Broad and narrow segments irregularly intermingled.*

C. *Blade of leaf 6 ft. long : petiole 1 ft. long.*

†Pohliàna, Mart. Stem 12–15 ft. high, slender, densely ringed, columnar or reedy : segments very unequal, linear-lanceolate, falcate-acuminate, few-nerved and many-nerved intermixed, 16–20 in. long. Trop. Brazil.

CC. *Blade 2–2½ ft.: petiole 4 in. long.*

†élegans, Mart., var. **robusta**, Dr. Stem 6 ft. high, 3–4 lines in diam.: segments rarely 3, usually 5–7, 1-nerved, 10–14 in. long, some 4 lines wide, intermixed with broader, many-nerved ones, all long, falcate-acuminate. Central Brazil.

BBB. *Leaf segments all alike (except the connivent apical ones).*

C. *Alternate, remote, linear, scurfy.*

***Riedeliàna**, H. Wendl. (*G. grácilis*, Lind. & André). Habit of *Cocos Weddelliana*, the whole plant sparsely covered with caducous, brown, shining scales : petiole slender, 1½ ft. or more long, terete below, flattened above : rachis triangular, bisulcate above : lvs. spreading, drooping at the apex ; segments 10–12 in. long, about 9 lines wide, linear-acute, elegantly recurved, the 2 terminal ones connivent. Brazil. I.H. 21:169.

CC. *Equidistant: petiole half as long as the blade.*

Schottiàna, Mart. Stem 9–15 ft. high, 1–1¼ in. thick : lvs. recurved, spreading; petiole half or more than half as long as the blade ; segments about 35 on each side, 10–12 in. long, two-fifths in. wide, equidistant, linear or linear-lanceolate, very long acuminate. E. Brazil.

The following are imperfectly described, but are in the trade : **G. imperiàlis*, Linden.—**G. princeps*, Linden.—**G. Pynærtiàna*, Hort. Belongs under A. One of the smallest lvs. measures 28 in. long by 10 in. at the broadest. Has not flowered yet, and the genus is therefore uncertain. R.H. 1898, p. 262. G.C. III. 23:258. F.E. 10:886.—*G. speciòsa*, Barb.-Rodr.

JARED G. SMITH, W. H. TAPLIN and W. M.

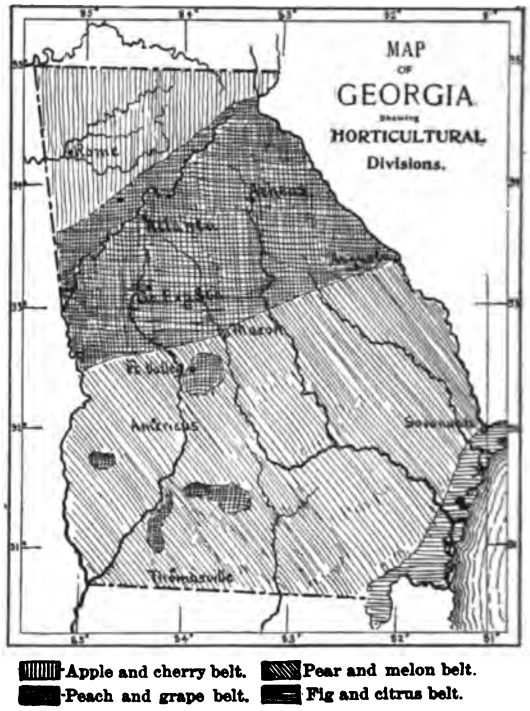
GEORGIA, HORTICULTURE IN. Fig. 900. The climatology of Georgia is unique. Latitude and altitude combine to exaggerate the four and one-half degrees covered by the state from south to north into at least ten, thereby embracing an extraordinary range of climate. In something less than 300 miles a transition is effected from a subtropical to an almost boreal vegetation.

Proceeding northwestwardly from the coast, the country rises gradually until it culminates in the Blue Ridge, the highest peaks of which (in Towns county, on the Tennessee line) stand a little more than 5,000 feet high. Intermediately may be found as varied a climate, and consequently as extended a range of horticultural production, as can be met with in a journey of a thousand miles due north and south, in a region of normal elevation, such as the Mississippi valley.

Measurably the geology of the state corresponds with its elevation and consequent climatology, and is not complex except in the extreme northwestern portion. Two formations—the tertiary and metamorphic—cover nine-tenths of its area. The Sea Islands, and coast for a short distance inland, are alluvial or quarternary, and here the vegetation is of a subtropical character—palmettoes and live-oaks on the islands and pines and hammock growth inland, together with the citrus, fig and olive families, where cultivated.

Slightly beyond the tide-water limit begins the vast sweep of the pine forests, known locally as the "Wire-grass Region," which extends inland some 160 miles, on an average, covering nearly the whole of the tertiary formation. A range of low sand hills, about 300 feet high, extending diagonally across the state, separates the tertiary and metamorphic regions. At its base the land has attained an average altitude of less than 200 feet.

From the summit of this ridge or terrace, formerly the primordial sea-beach, stretches the metamorphic region—the red clay or cotton belt—rising gradually toward the northwest until the Piedmont escarpment is reached—another low hill range on the southern side of and parallel to the Chattahoochee river valley. The height of this escarpment varies from 1,000 to 1,500 feet. Beyond this are the Appalachian foothills and then the mountains, in very irregular formation, their spurs radiating in all directions.



900. Georgia, to show borticultural regions.

In extreme northwest Georgia the surface dips in a general way toward the Tennessee river valley (elevation 700 feet), interspersed, however, with a chaos of mountains and coves, with a complex tangle of geological formations, from lower silurian to eocene.

The prevailing natural growth of the tertiary is yellow pine—that of the metamorphic region hard woods, embracing nearly all of the North American species, oak and hickory predominating.

All this has been a necessary preface to a division of the state into separate horticultural areas, which correspond in the main with its geological features, and may be classified as follows :

Horticultural Areas :	*Corresponding Geological Divisions.*
1. FIG AND CITRUS BELT	Quarternary Formation
2. PEAR AND MELON BELT	Tertiary Formation
3. PEACH AND GRAPE BELT	Metamorphic Formation
4. APPLE AND CHERRY BELT	Tennessee Dip

1. *The Fig and Citrus Belt.*—In this zone the citrus family does not thrive indigenously, nor is it planted for commercial purposes. Yet oranges and lemons live and bear unprotected, though latterly subject to injury from frost. It is the home of the Ogeechee lime, and formerly both indigo and the olive flourished on the Sea Islands, but their culture has been for many years abandoned. Figs grow to perfection. About the ports—especially Savannah—heavy trucking is followed for the northern market—chiefly potatoes, strawberries, cabbages, celery, tomatoes, onions and peas.

2. *The Pear and Melon Belt.*—The sandy soil of the tertiary is especially adapted to the melon and the oriental pear—the former over its entire area, the latter mainly in the southern part. These form two of the leading horticultural industries in this section. The Georgia melon is extensively shipped and widely known throughout the continent. Zymotic blight has of late greatly checked the pear industry, and discouraged the growers. In isolated locations, wherever there exist well defined elevations above the surrounding country—islands, possibly, of the tertiary sea, prematurely uplifted—they have been converted into vast peach orchards of hundreds of thousands of trees—in the Marshallville and Fort Valley district (the birthplace of the Elberta) running into millions.

Japan plums also thrive in the "Wiregrass," and are now attaining considerable commercial importance. Figs yield abundant crops throughout this zone. Most of the Labrusca type of grapes and all of the Æstivalis type succeed admirably in the elevated portions and are beginning to be extensively cultivated; but the Scuppernong (*Vitis rotundifolia*) is the typical grape of the section. The strawberry does only moderately well—frequently summer-scalds. All blackberries thrive, but raspberries are not generally successful.

But the "Wiregrass" is the home of the sweet potato. Here the pumpkin yam and Georgia yam attain their highest perfection.

3. *The Peach and Grape Belt.*—It is an anomaly that while the metamorphic region, with its red clay soil—especially on the Piedmont escarpment—is the home of both the peach and the grape, most of the great commercial orchards of the state are located in the "outcropping peach districts" of the tertiary. Cheaper lands and earlier maturity are the cause. Yet naturally the metamorphic region is peculiarly adapted to peach and grape culture, and it was here that both attained their first development in this state. More species of grapes and a greater number of varieties of each species will attain perfection in middle and Piedmont Georgia than in any one region of America east of the Rockies—a sweeping assertion, but facts sustain it. Labruscas, Vulpinas, Æstivales, Rotundifolias—all seem equally to thrive; but prices are poor, and grapes are everywhere giving way to peaches, with apples on bottom lands, although this is not an apple region.

Japan plums usually do not do so well as in the "Wiregrass." Native plums are not profitable—even the Wild Goose is unsatisfactory. Figs are uncertain, and in the northern portion of the zone require winter protection. Strawberries and blackberries are excellent, and raspberries quite successful in the Piedmont area and northward. Gooseberries and some currants do well in certain portions of the mountains, but not south of the escarpment.

4. *The Apple and Cherry Belt.*—Apples do not do equally well throughout the entire division styled the "Tennessee Dip." Yet in many localities, especially in the mountain coves, they thrive as well as in western N. Carolina or Vermont. This is notably the case in Pickens, Gilmer, Murray and Fannin counties, which are famous for their apples. Cherries, especially Morellos, form a safe crop here, and, in general, most of the horticultural productions of a much higher latitude find a place.

Insect and fungous affections have to be combated in all parts of Georgia, just as elsewhere (except in certain portions of the mountains, where neither are as yet introduced). Growers are generally learning, however, the value of the spray pump.

The San José and other scales have invaded the state, especially in the southern portion, where some twenty-odd counties report infestation. But they are being intelligently combated, for the most part, and it is hoped that they will be steadily held in check.

The main trouble with the Georgia fruit-grower (aside from pear blight and the premature blooming of peaches) is the curculio. Thousands of dollars are annually spent in "jarring" for this pest, but it still remains a serious menace.

Hugh N. Starnes.

GEORGINA. A synonym of Dahlia, which still lives in the form of "Georginen," the popular name of Dahlias in Germany

GERANIUM, FEATHER. See *Chenopodium Botrys.*

GERÀNIUM (Greek, *crane;* from the resemblance of the fruit to a crane's bill). *Geranidceæ.* Crane's-bill. Generally herbaceous plants, usually caulescent: lvs. simple, alternate or opposite and much lobed, sometimes almost radical: fls. regular; sepals 5, imbricated; petals 5; stamens 10, in two rows; anthers 10: seed when ripened separated from the ovary and with its awn bent sinuously. The genus Erodium, its nearest ally, has but the inner row of stamens furnished with anthers and the awn of the seed is bent spirally. The Geraniums of common speech are classed in the genus Pelargonium, having at the side of the pedicel a distinct narrow tube and zygomorphic flowers. The genus Geranium has over 150 species, found in the temperate zones particularly of the northern hemispheres, very few in the tropics. Valued for the border or rockery, and the roots of some, as *G. maculatum,* find use in medicine on account of their astringency. Thrive well in ordinary garden soil, and are propagated by seeds and division of roots.

The following is an alphabetical list of species and varieties described below:

album, 17, 18, 19.
argenteum, 1.
Armenum, 4.
Backhousianum, 4.
Balkanum, 21.
cinereum, 2.
collinum, 11.
Endressi, 5.
erianthum, 13.
flore pleno, 9.
Ibericum, 8.
incisum, 13.
Lancastriense, 6.
Londesii, 11.
macrorrhizum, 7.
maculatum, 14.
phæum, 10.
platypetalum, 8.
plenum, 14.
pratense, 9.
Richardsoni, 20.
Robertianum, 3.
sanguineum, 6.
Sibiricum, 21.
sylvaticum, 21.
tuberosum, 21.
Wallichianum, 16.

a. *Fls. red or pink.*

b. *Stature very dwarf.*

1. **argénteum,** Linn. Silver-leaved Crane's-bill. About 3 in. high: lvs. almost radical, on long petioles, 5–7-parted, with 3-fid linear lobes, both surfaces hoary: peduncles almost radical, 1- or 2-fld.: fls. large, pink, with darker veins; petals emarginate. Middle of June to Aug. Carnic Alps. B.M. 504. L.B.C. 10:948.—One of the best for the rockery. Often acts as a biennial in N. E.

2. **cinèreum,** Cav. Gray Crane's-bill. Like *G. argenteum,* but 2-fld. and paler in color: lvs. not as hoary in appearance. June, July. Pyrenees.

3. **Robertiànum,** Linn. Herb Robert. Red Robin. About 9 in. high: lvs. thin, ovate-orbicular, 3–5-parted, with 3-fid pinnatifid lobes: peduncles slender, 2-fld.: fls. small, bright crimson. June to Oct. Amer., Eu., Asia and N. Afr. B.B. 2:341.—For the rockery, and delights in a moist soil and some shade. Odor disagreeable.

bb. *Stature 1 ft. or more.*

4. **Armènum,** Boiss. (*G. Backhousiànum,* Regel ?). About 2½ ft. high: lvs. radical, upright, orbicular, with 5 deep lobes: fls. about 1½ in. across, inclining to a dark crimson. All season at irregular intervals. Armenia. R.H. 1891, p. 350.—A very vigorous and floriferous species. Sometimes growing 4 ft. high.

5. **Éndressi,** J. Gay. About 18 in. high: lvs. opposite, palmate, 5-lobed, upper ones 3-lobed, serrated: peduncles axillary, 2-fld.: petals entire, fringed at base, light rose, darker veined. Summer. Pyrenees.—Among the best for the border, and useful for cutting.

6. **sanguíneum,** Linn. About 1½ ft. high, with stem occasionally forked, erect: lvs. all petiolate, mostly 7-parted, with 3–5-lobed linear lobules: peduncles long, mostly 1-fld.: fls. very large, blood-red. June to Aug. Eu.—One of the best species in cult.

Var. **Lancastriénse,** Hort. A dwarfer form, smaller and with less deeply lobed foliage. Fls. lighter in color, veined purple.

7. **macrorrhìzum,** Linn. A large-rooted species, about 1½ ft. high, with a stem suffruticose at base: lvs. smooth, round, basal ones 5-lobed, cauline 3-lobed, toothed and often colored red: calyx inflated; petals spatulate and blood-red in color. May to July. S. Eu. B.M. 2420.

AA. *Fls. blue or violet.*

8. **Ibèricum,** Cav. IBERIAN CRANE'S-BILL. From 1-1½ ft. high : stem erect and leafless below, above dichotomously branched, villous: lvs. opposite, 5-7-parted, with deeply cut lobes and toothed lobules : fls. 1 in. across, in showy, open panicles, violet. July, Aug. Iberia. B.M. 1386.

Var. **platypétalum** (*G. platypétalum*, Fisch. and Mey.). Slightly shorter than the parent, with lvs. less deeply lobed and lobes less pointed : fls. deeper and richer in color, and also larger.

9. **praténse,** Linn. MEADOW CRANE'S-BILL. About 2½ ft. high, with an upright round stem : lvs. mostly hand-shaped, with 7 lobes, each deeply cut : peduncles mostly 2-fld., drooping after flowering : fls. large, blue; petals entire. June, through Aug. Eu.—Var. **flore plèno.** Not as tall as parent. Very numerous deep blue fls. in clusters. June and July, and often again in fall.

901. Geranium maculatum (× ⅓).

AAA. *Fls. dark blue, almost black.*

10. **phæ̀um,** Linn. About 2 ft. high, with upright, short-haired stem, glandular above : lvs. 5-7-lobed and deeply toothed : peduncles 1-2-fld.: petals spreading, obovate, unequally notched and often with a small spur, very dark blue, almost black, with white spot at base of each petal. May, June. Cent. and western Eu.—A good border plant.

AAAA. *Fls. purple in various shades.*

11. **collinum,** Steph. (*G. Londesii*, Fisch.). Height 2-3 ft.: stem angular and slightly decumbent: lvs. palmately 5-parted, deeply divided and cut: petals entire, purple, with a tinge of violet. June, July. Eastern Eu.—One of the showiest in its season. Should be cut back before seeding, to induce second bloom.

12. **Frèmontii,** Torr. About 1 ft. high, sometimes subacaulescent : upper lvs. 3-5-cleft, lower ones 7-cleft, with 3-fid or incised lobes: fls. light purple. Rocky Mts. Recently introduced. Blooms all summer.

13. **incisum,** Nutt. (*G. eriánthum*, Lind.). About 1 ft. high, leafy branched: lvs. finely cut: pedicels conspicuously glandular-pubescent: petals with stiff white hairs, inner surface purple, about 1 in. wide. Ore.—A hardy species well worth growing. Not perfectly hardy near Boston.

14. **maculàtum,** Linn. WILD or SPOTTED CRANE'S-BILL. Fig. 901. The common American species, about 1½-ft. high: stem angular: basal lvs. long-petioled, deeply 3-5-parted; stem-leaves opposite, shorter petioled: peduncles 1-5, inflorescence often umbellate: fls. 1-1½ in. broad, rose-purple; petals woolly at base. June, July. N. Amer. G.W.F. 3. B.B. 2:341.—Showy native species; should be more in cultivation. Grows best in somewhat wet places. Var. **plènum,** a double-flowered variety of deeper color.

15. **Richardsoni,** Fisch. & Trautv. About 1½ ft. high: lvs. thin and terminal, lobe of the uppermost lvs. longer than the often greatly reduced lateral lobes: pedicels conspicuously glandular pubescent: fls. large, reddish purple; petals with long white hairs on inner surface. Colo. and west.—Stems and young growth tinged with red.

16. **Wallichiànum,** D. Don. Of prostrate trailing habit: stem and lvs. covered with silky hairs : lvs. light green, 5-parted, with deeply toothed lobes : fls. large, purple, borne sparingly all summer. Himalayas. B.M. 2377.—For the rockery.

AAAAA. *Fls. white.*

17. **Ibéricum, var. album.** A white-fld. var. of No. 8.

18. **maculàtum, var. album.** A white-fld. var. of No. 14.

19. **praténse,** var. **album.** A white-fld. var. of No. 9.

20. **Richardsoni.** This species (No. 15) in its native habitat is usually white, mostly roseate-veined.

21. **Sibiricum,** Linn. SIBERIAN CRANE'S-BILL. A slender, somewhat forked plant, villous, 1-2 ft. high: lvs. deeply 3-5-parted: peduncles slender, usually 1-fld.: fls. very small, dingy white. June through Aug. Siberia, and naturalized near New York. B.B. 2:341.—Another form under same name, with brick-red fls., said to be in cultivation.

G. Balkànum, Hort. A hardy plant, with fragrant foliage: fls. on radical stems, 1 in. across, dark magenta. June.—*G. sylváticum*, Linn. About 2 ft. high, with a soft-haired, upright, round stem: lvs. 5-7-parted, lobes oblong, deeply toothed: fls. purple or violet. June, July. The common wood Geranium of Europe.—*G. tuberòsum*, Linn. Tuberous-rooted, 9-15 in. high, with stem at base naked: lvs. many-lobed, linear and serrate: pedicels 1-2-fld.: fls. large, violet. May. S. Eu.

G. N. LAUMAN.

GERÁRDIA (after John Gerarde, 1545-1607, perhaps the most popular of the herbalists). *Scrophulariàceæ.* Hardy annual and perennial herbs, all American, and mostly of the Atlantic states, with yellow or rosy purple fls., in late summer and autumn, the latter color rarely varying to white: lvs. mainly opposite: calyx 5-toothed or cleft; corolla bell- to funnel-shaped, broad throated, 5-parted, the 2 posterior lobes often smaller and more united; stamens commonly more or less hairy; anthers more or less approximate in pairs: capsule globose, 2-grooved : seeds usually angled, loose coated. The first 3 species described below belong to a section in which the roots are more or less parasitic. These plants are therefore rather difficult to cultivate, and are offered only by collectors. *G. tenuifolia* is offered by one dealer, the seeds presumably gathered in European gardens.

A. *Fls. yellow.*

B. *Corolla pubescent outside: biennial or annual.*

Pediculària, Linn. Pubescence partly glandular and viscid, especially on the pedicels and calyx, while in the next 2 species there is no glandular pubescence. Lvs. 1-2 in. long, all pinnatifid. N. Am.

BB. *Corolla glabrous outside: perennial.*

C. *Height 3–6 ft.*

quercifòlia, Pursh. Stem at first glaucous: lower lvs. 3–5 in. long, 1–2-pinnatifid: upper lvs. often entire. Dry woods, N. Am.

CC. *Height 1–2 ft.*

lævigàta, Raf. Not glaucous: lvs. 1½–4 in. long. Oak barrens, etc., N. Am.

AA. *Fls. rosy purple rarely varying to white.*

B. *Height 1 ft.*

tenuifòlia, Vahl. Height 1 ft.: branching, paniculate: inflor. racemose: lvs. mostly narrowly linear: corolla ½ in. long. Low or dry ground, N. Am.

BB. *Height 2–3 ft.*

linifòlia, Nutt. Perennial: lvs. erect, very narrowly linear, 1 line wide: calyx teeth minute; corolla 1 in. long. Low pine barrens, N. Am. Not cult., but said to be a parent with *Pentstemon pulchellus* of **G. hybrida**, Hort. Int. by Haage & Schmidt, 1899. The poor cut in S.H. 2:485 seems nearer Pentstemon than Gerardia.

W. M.

GERMANDER. See *Teucrium.*

GESNÈRIA (Conrad Gesner, Zurich, 1516–1565, celebrated naturalist, and considered to be the originator of the idea of genus in taxonomy). *Gesneràceæ.* Sometimes written *Gesnera.* More than 50 herbs of tropical America (chiefly Brazilian), with simple, opposite lvs. and showy tubular fls. in terminal short panicles or fascicles. Calyx campanulate, 5-parted; corolla long, straight or curved, more or less ventricose, the base often distinctly swollen or gibbous, the limb mostly shallow-toothed and nearly regular or bilabiate; stamens 4, didynamous (in pairs under the upper lip); style 1, long; glands on the disk in the fl. Handsome warmhouse plants (mostly tuberous) allied to Achimenes, Gloxinia, Isoloma and Streptocarpus. Some of the Gesnerias of the trade belong to Nægelia, which differs, amongst other things, in having an annular or ringed disk rather than a disk of distinct glands.

L. H. B.

Gesnerias are tuberous bulbous, or rhizomatous plants. They are natives of tropical S. America and Mexico, and all have a period of rest corresponding with the dry season. The stems rise directly from the rootstock. They are clothed with opposite, mostly heart-shaped, sometimes ovate, leaves. They are densely hirsute; the hairs often are brightly tinted, giving them a sheen like the plumage of birds, so that they are quite as much admired for their handsome foliage as for the flowers. The inflorescence is generally a branched corymb, and the flowers are tubular-labiate, with the limb rarely flattened, as in Achimenes. Gesnerias are not nearly as popular as they once were, probably on account of the transitory character of their corollas, which are continually falling, lasting but a day or two. The roots must be kept in a moderately warm place, such as would suit Gloxinias. They should be kept in the pots in which they have grown, and be watered about once a week during the resting period. It is a mistake to suppose the roots can be kept in dry sand and still retain their vitality. When the roots show a tendency to send up stems is the time to start them, picking out the advanced ones first. In this way a long season can be secured. They need a light soil to start with, about equal parts leaf-soil, loam and sand, and should be placed in a moderate temperature. Very little water will be required until they are well started. If it is desired to increase stock, smaller bulbs may be boxed off, and cuttings made of surplus shoots. Seeds are produced rather freely, and some good hybrids are in cultivation. As they advance in growth, larger pots will be needed, and a little stronger soil,—the mixture divided into four parts, adding well-decayed manure. They will take abundance of water and some liquid manure when coming into bloom. If neatly trained they make handsome specimens. Their beautiful foliage is liable to be spoiled by impurities or sediment in water, so that we avoid overhead syringing, particularly as they develop. After blooming, a good light place should be given, and the plants watered until they show signs of going to rest. As they are naturally an undergrowth, a light shading will be beneficial in the hottest weather.

Cult. by T. D. HATFIELD.

A. *Lvs. green.*

cardinàlis, Lem. (*G. macrántha*, Hort.). Stem 6–12 in. high, stout and hairy: lvs. large, cordate-ovate, crenate-dentate, petioled: fls. red, tubular, hairy, slender (2–3 in. long), the upper lip projecting and the lower one almost wanting, borne in a terminal, more or less flat cluster. Nativity unknown. Gn. 42:874.—*G. Duvali*, Hort., is evidently only a slender form of this species.

Héndersoni, Hort. Lvs. velvety green: fls. 3 in. long, brilliant scarlet, in a large truss. Probably of garden origin.

longiflòra, Hort., is a small-leaved species, with drooping, long-tubed nicotiana-like white fls. Gn. 33:644.—The botanical position of this plant is in doubt. It is not the *G. longiflora*, HBK., which is purple-fld., nor *G. longiflora*, DC., which is *Achimenes longiflora*. By some it has been confounded with *Isoloma longifolium*, Decne.

AA. *Lvs. richly colored, at least underneath.*

Lèopoldi, Scheidw. Compact: stem erect from the large, depressed tuber, thinly hairy: lvs. verticillate in 4's, broadly ovate-acuminate, more or less unequal at base, dentate, green above and purple beneath: fls. long-tubular, thinly hairy, the lobes nearly equal; light scarlet, in a rather loose, umbel-like cluster. Nativity not recorded. F.S. 7:704–5. Gn. 53:1176.

Donkelæriàna, Lem. (*G. Dónkelarii*, Hook.). Stem often 2 ft. tall: lvs. large, cordate-ovate, crenate, hairy, green and purple-tinged above and purple beneath: fls. tubular-campanulate, the rounded lobes nearly equal, dull red, 2 in. long, hanging from long pedicels in a large panicle. Variable. Colombia. B.M. 5070. R.B. 21:97. F. 1853:241.

Exoniénsis, Hort. Hybrid: lvs. velvety, with red and purple hairs: fls. bright orange-red, in close clusters.

refúlgens, Hort. Hybrid: lvs. cordate-oval, red-hairy: fls. deep red or vermilion.—One of the best.

G. cinnabarina, Lind., is a Nægelia.—*G. Guatemalénsis*, Hort., "a free grower and bloomer, fls. orange," was once offered by Saul.—*G. jasminiflòra*, Hort., "fls. of the purest white, freely produced, beautiful," once offered by Saul.—*G. oblònga*, Hort., fls. orange, offered once by Saul.—*G. robústa*, Hort., "vermilion, beautifully spotted and tigered," offered once by Saul.—*G. zebrina*, Paxt., see Nægelia. The Gesnerias are much confused by hybridizing and breeding.

L. H. B.

GÈUM (Greek, *geuo*, to have a taste; referring to the roots). *Rosàceæ.* This genus includes some fine hardy border and rock plants, some of which are valued for their bright red fls.; some for their pure yellow fls.; others for their long plumy fruits. Herbs, with a perennial rhizome, sometimes stoloniferous: root-lvs. crowded, odd-pinnate, the alternate lobes often smaller, terminal ones largest; stem-lvs. few, mostly of 3 lfts. or bract-like: fls. 1–2 in. across, solitary or corymbose. More than 30 species, mostly in temperate and frigid regions.

The plumy kinds are all contained in the subgenus Sieversia. *G. Chiloense* is the best species, and in the gardens is commonly seen in double forms. A gardener writes that "inferior forms show scarcely any duplicity." Geums are of easy culture, and are prop. by division or seed. It is said that they hybridize freely if grown together. The dwarf kinds are suited only to the rockery. Correvon, of Geneva, Switz., writes that *G. reptans* is one of the best of the rockery kinds, and needs full sunlight. For *G. triflorum* he advises half exposure to sun and a light, moist soil. *G. rivale* grows naturally in marshy places.

A. *Plumy Geums: style in fruit long and plumose.*

B. *Fls. yellow.*

C. *Plants spreading by runners.*

réptans, Linn. Root-lvs. interruptedly pinnatifid: upper lvs. 3-lobed: fls. erect; petals obcordate. Eu. Gn. 45:956.—The purple styles are pretty.

cc. *Plants not spreading by runners.*

d. *Root-lvs. pinnatifid.*

montànum, Linn. Calyx lobes entire, while those of reptans are often 3-cut at apex. S. Eu. G.C. II. 13:425. Gn. 45, p. 285.

dd. *Root-lvs. kidney-shaped.*

radiàtum, Michx. Very hirsute. Root-lvs. 2–5 in. broad: stem 1–5-fld.: bractlets minute. Mountains of N. C.—Int. by H. P. Kelsey.

bb. *Fls. bright red, unmixed with yellow.*

c. *Lateral lobes of lvs. minute.*

coccineum, Sibth. & Sm., not Hort. "Stem-lvs. 3-lobed: root-lvs. lyrate, the terminal lobe largest, cordate-reniform: fls. erect. Mt. Olympus in Bithynia." The above is an exact translation of the entire description given by Sibthorp and Smith, Flora Græca, t. 485.—The chances are that all the plants in the trade under this name are really *G. Chiloense.*

cc. *Lateral lobes of lvs. 1 in. long.*

Chiloénse, Balb. (*G. cóccineum*, Hort., not Balb.). "Stem-lvs. 3-parted, laciniate; root-lvs. interruptedly lyrate, pilose: terminal lobe rotund, somewhat 3-lobed, crenate: fls. panicled: carpels villous." The above is a literal translation of B.R. 16:1348, where the terminal lobe is shown to be 2⅓ in. each way. Chile. B.R. 13:1088, and under 1099. L.B.C. 16:1527. Gn. 14:156; 45, p. 284. R.H. 1890, p. 305, and 1881, p. 309, all erroneously as *G. coccineum.*

Var. **miniàtum**, D.K. (*G. miniàtum*, Robt. Parker), has fls. about 2 shades lighter in color. A robust form growing 2–3 ft. high, easily prop., and fls. from Apr. to end of July. Gn. 38:772, where it is supposed to be a hybrid of *G. Chiloense*, var. *grandiflorum* × *G. aureum*, which is a rubust many fld. form of *G. montanum*, or else of *G. Chiloense* × *G. urbanum.*

Var. **grandiflòrum**, D.K., is an improved form. "The double-fld. form of this seems to be a more general favorite, the blooms lasting longer, though I think they lack the elegance of those of the simple form. They begin to expand soon after May and are produced until Oct." *D.K., in Gn. 38, p. 299.*

bbb. *Fls. chiefly dull red, mixed with yellow.*

triflòrum, Pursh. Low, softly hairy: lfts. very numerous and crowded, deeply cut: fls. 3 or more on long peduncles; calyx purple, as long as the petals. Coulter says the petals are erect. Arctic Am. L.B.C. 17:1609. "Fruit showy all summer." *Woolson.*

aa. *Not long and plumy in fruit.*

b. *Style jointed and bent in the middle.*

c. *Fls. purplish orange.*

rivàle, Linn. Root-lvs. lyrate; stem-lvs. few, with 3 lobes or lfts.: calyx brownish purple; petals purplish orange. N. temp. regions. Var. **album** is also sold.

cc. *Fls. golden yellow.*

macrophýllum, Willd. Eastern plant, which F. W. Barclay says is offered by collectors, and prefers a moist, sunny place. B.B. 2:221.

bb. *Style not jointed, straight.*

Róssii, Seringe. Slightly pubescent above: scape 1-3-fld.: styles glabrous. Colo., arctic regions.—Fls. large, bright yellow.

G. atrococcineum, Hort., may be a typographical error for G. atrosanguineum.—*G. atrosanguineum*, Hort., is presumably a form of *G. Chiloense*, with darker fls. than the type, and sold mostly, if not entirely, in its double condition.—*G. Japónicum*, Thunb., is sold, but little known. St. flexuose, hirsute: lvs. 3–5-lobed, hirsute: fls. erect, yellow: petals as long as the calyx: fr. hirsute, awned, recurved. Japan.

W. M.

GEVUÌNA (from the Chilean name). Also written *Guevina*. *Proteàceæ.* One species, **G. Avellàna**, Molina (Syn., *Quádria heterophýlla*, Ruiz & Pav.). CHILEAN NUT. CHILE HAZEL. An evergreen tree, with large, alternate pinnate, dark green, glossy lvs. and white, hermaphrodite fls. in long, axillary racemes. Fruit about the size of a cherry, coral red when ripe, the seed having a pleasant flavored kernel, resembling the hazel in taste and largely used by the Chileans. Sparingly grown in California. Prop. by seeds or by green cuttings under glass.

W. A. TAYLOR.

GHERKIN. A small Cucumber. The Burr or West Indian Gherkin is *Cucumis Anguria.*

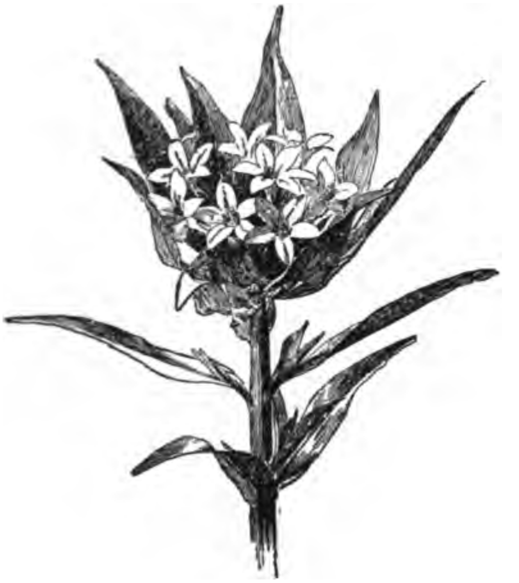
GIBB, CHARLES, Canadian horticulturist, and author of important works on Russian fruits and other hardy trees, was born at Montreal June 29, 1842, and died at Cairo, Egypt, March 8, 1890, while returning from a collecting trip in China and Japan. In 1872 he brought to Montreal the first canned fruit exhibited in Canada. His farm at Abbotsford, Province of Quebec, contained the best collection of hardy fruits, trees and ornamental shrubs in Canada. His trip to Russia in 1882 with Prof. J. L. Budd, the subsequent importations, his second trip to Russia, and his various publications on hardy trees make part of a chapter of great interest and significance in the history of American horticulture. His travels were extensive. His chief works are "Ornamental and Timber Trees not Natives of the Province of Quebec" (a comprehensive list of species of possible value for Canada), "Report on Russian Fruits," "Hasty Notes on the Trees and Shrubs of Northern Europe," "Russian Apples Imported by the Department of Agriculture, Washington, in 1870" (an elaborate comparison of Russian opinions and American experience), "Nomenclature of the Russian Apples," "Of Translating and Rendering into Euphonious English Unpronounceable Russian Names, also Throwing Out Synonyms," and "Fruits for the Cold North." For a fuller account, with portrait, see Annals of Horticulture, 1890, 287–290.

W. M.

GIDEON, PETER M., pioneer pomologist of the northern Mississippi states, 1818–1899, resided since 1853 on Lake Minnetonka, Minnesota, and devoted his efforts to the production of apples of sufficient hardiness to withstand the climate. He was born in Ohio. He afterwards lived in Illinois. From boyhood he seems to have been possessed of the idea to raise seedling fruits. He was one of those rare individuals who sets a distinct ideal and strives for it throughout a lifetime in spite of every adversity. These are persons of strong and uncompromising wills. They often antagonize their fellows; but their works are usually beneficent. Gideon conceived that the amalgamation of the Siberian crab and the common apple would give the perfect apple for the Northwest. His seedlings were numerous. Several of them have been named and disseminated, and are of value. But his greatest achievement, the Wealthy apple, was of pure *Pyrus Malus* stock. This variety is now one of the standard apples of his geographical region, and it is gaining favor elsewhere. It is a boon to the Northwest. Even when in poverty, it is said that Mr. Gideon spent his last dollar to buy the seeds from which this apple came. He was instrumental in distributing 10,000 apple seedlings in Minnesota, and some of these are now attracting attention. His work was wholly empirical, yet he did so much and continued his work for so long a time that the results have contributed to the knowledge of plant-breeding. Probably no other American has labored so long and devotedly for the attainment of a specific ideal in the apple. Portrait and eulogies will be found in The Minnesota Horticulturist, Jan., 1900.

L. H. B.

GÌLIA (Philipp Salvador Gil, Spanish botanist of the latter half of the eighteenth century, collaborator with Xaurez). *Polemoniàceæ.* American herbs, mostly of western North America, of nearly 100 species, as the genus is now understood by most botanists. Fls. small, of many colors, the corolla funnel-form to bell-shape or sometimes salver-form, 5-lobed; stamens 5, inserted near the base of the corolla tube, the filaments usually naked: ovary 3-loculed, with axile placentæ, the stigmas 3 (or sometimes 2). Gilia is a very polymorphic genus, into which Gray now (Syn. Fl. 2, pt. 1, suppl.) throws Collomia, Linanthus, Leptosiphon, Leptodactylon, Navarretia, Hugelia, Ipomopsis, Fenzlia. In this conception, Gilia is defined as follows: "Fls. naked, not involucellate; calyx partly herbaceous, scarious below the sinuses; lobes narrow and acute; corolla salverform or funnel-form to campanulate or almost rotate;



902. Gilia grandiflora (× ¾).

filaments not bearded at base: seeds wingless: herbs, or a few suffruticose."

Several of the Gilias are popular garden annuals or biennials (a few perennial). They are of the easiest culture, being vigorous, hardy and floriferous. They are mostly dwarfish, and are excellent for low masses, edgings or rockeries. Seeds may be sown where the plants are to grow. Any good soil will suit them.

Following are the names in the American trade:

achilleæfolia, 8.
aggregata, 11.
alba, 6, 13, 16.
androsacea, 14.
aurantiaca, 10.
aureus, 15.
capitata, 6.
carmineus, 15.
coccinea, 2.
Collomia, 1, 2.
congesta, 4.
coronopifolia, 10.
debilis, 5.
densiflora, 13.
dianthiflora, 16.
dianthoides, 16.
elegans, 10, 11.
Fenzlia, 16.
grandiflora, 1.
hybridus, 15.
Ipomopsis, 10, 11.
laciniata, 7.
Leptosiphon, 13, 14, 15.
liniflora, 12.
linifolia, 12.
micrantha, 15.
minima, 3.
Navarretia, 8.
nivalis, 9.
rosea, 9, 15.
sanguinea, 10.
speciosa, 16.
tricolor, 9.

A. *Lvs. normally alternate, entire or pinnately cut or divided (lower lvs. sometimes opposite).*

B. *Fls. in dense heads, which are subtended by leafy involucres.*

C. *Foliage entire or at least not much parted.*

1. **grandiflòra**, Gray (*Collòmia grandiflòra*, Dougl.). Fig. 902. Erect, with minutely pubescent reddish stems, 1–2 ft. high: lvs. linear-lanceolate or oblong, narrowed below but scarcely petioled, entire, acute: fls. many, in dense terminal heads, buff or salmon color, redder inside, 1 in. long. Plains, W. of Rocky Mts. B.M. 2894. B.R. 14:1174.—This and the next are interesting annuals. Useful as bee plants.

2. **coccínea**, Gray (*Collòmia coccinea*, Lehm.). More slender: stems not red: lvs. narrower (mostly linear), somewhat cut at the ends: fls. smaller, slender-tubed, yellow or buff outside and brick-red inside. Chile. B.R. 19:1622.

CC. *Foliage pinnately parted or compound.*

3. **mínima**, Gray (*Navarrètia minima*, Nutt.). Dwarf and tufted (3 in. or less high), nearly glabrous: lvs. needle-like, pinnately parted: fls. white, the corolla scarcely exceeding the white-hairy calyx. In arid districts, Dak. W.

4. **congésta**, Hook. A foot or less high, erect or spreading, tufted: lvs. mostly 3–7-divided into linear divisions: corolla white, the oval lobes nearly as long as the tube: calyx teeth long-pointed, nearly equaling the corolla. A small-fld. species growing from Wyo. W.

BB. *Fls. not in close heads, but more or less scattered: or if capitate, the heads not leafy-subtended.*

C. *Plant perennial: seed only 1 in a locule: fls. small.*

5. **débilis**, Wats. Two in. or less high: lvs. oblong, entire or 2–3-lobed, petioled: fls. solitary and nearly sessile, the purple corolla ⅜ in. long, the tube exceeding the calyx. S. Utah.—Offered by collectors.

CC. *Plant annual: seeds more than 1 to the locule: corolla distinctly tubular, but relatively small.*

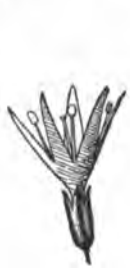
D. *Inflorescence capitate.*

6. **capitàta**, Dougl. Fig. 903. Plant 18 in. to 2½ ft. tall, the stems long and nearly straight between joints: fls. about ½ in. long, in dense, nearly globular heads, which terminate long, naked stems; corolla lobes lance-linear, acute: lvs. cut into very unequal linear lobes. Calif. and Ore. B.M. 2698. B.R. 14:1170.—An old favorite. There is a white form (var. **alba**). There is also a var. **major**.

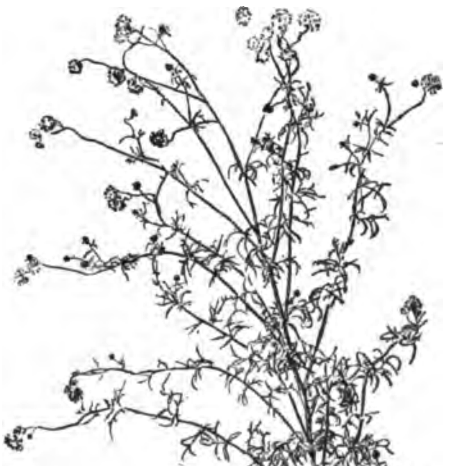
7. **laciniàta**, Ruiz & Pav. Much like the last in botanical characters, and possibly a form of it; lower and much more slender, the leaf-divisions mostly very narrow (usually almost thread-like), the heads smaller or the fls. sometimes even scattered. Chile.—The fine foliage and compact habit make this species an excellent garden plant.

DD. *Inflorescence mixed, capitate on the main branches, scattered on the others.*

8. **achilleæfòlia**, Benth. Fig. 904. Stout (2–3 ft.) and very branchy and bushy, the early main branches terminating in large, dense heads, but the later, finer growth bearing scattered fls.: lvs. small, with short, linear lobes or teeth: fls. large, violet or purple-blue,

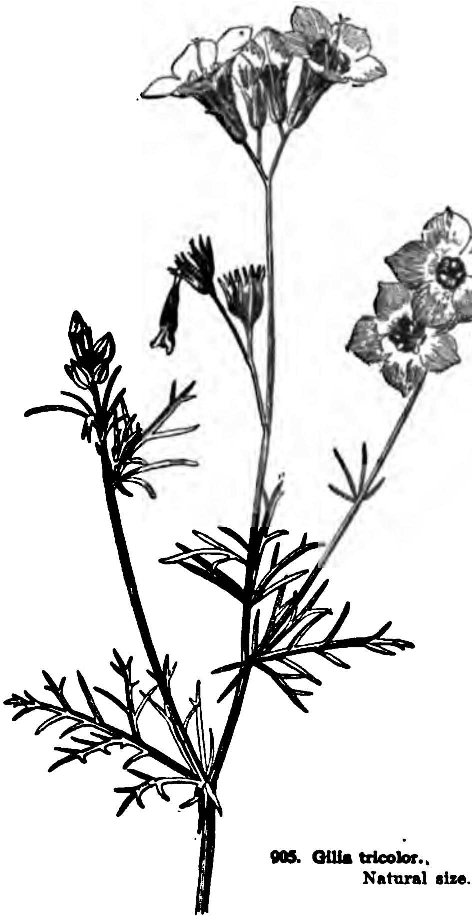


903. Flower of Gilia capitata. (×2.)



904. Gilia achilleæfolia. (×¼.)

the corolla lobes oblong or obovate: capsules large. W. Calif. B.M. 5939 (showing only capitate inflorescence).—An old garden plant. Fls. vary to white and rose.



905. Gilia tricolor.. Natural size.

DDD. *Inflorescence scattered or loosely cymulose.*

9. **tricolor**, Benth. Fig. 905. A very diffuse, twiggy grower, 2–2½ ft. high, sparsely pubescent: lvs. few on the full grown plant, small, with many short, very narrow or needle-shaped divisions: fls. comparatively large (¾ in. long or nearly so), nearly or quite bell-shaped, the corolla 2–3 times the length of the calyx; color of the roundish lobes violet and passing to whitish at the base, of the throat brown-purple and of the tube yellow. W. Calif. B.M. 3463. B.R. 20:1704.—One of the commonest of garden annuals. There is a white form (*G. nivàlis*, Hort.) and a rose-colored form (*G. ròsea*, Hort.). Thrives with the least care, and is always a profuse bloomer.

CCC. *Plant biennial: seeds few or many in each locule: fls. large aud long-tubular, red (running into white forms), the corolla very much surpassing the subulate calyx lobes. (Ipomopsis.)*

10. **coronopifòlia**, Pers. (*Ipomópsis élegans*, Poir. *I. aurantìaca* and *I. sanguínea*, Hort.). STANDING CYPRESS. Stem strict and unbranched, sometimes 6 ft. high, very leafy: lvs. pinnate, the divisions needle-like and about 1 in. long: fls. many, 1½ in. long, long-trumpet-shape, borne along the sides of the summit of the stem, the calyx inconspicuous amongst the short bract-lvs., the corolla scarlet or pink-red and dotted and yellowish within, varying to orange, its lobes obtuse or nearly so and flaring. In dry soil, S. Car., south and west. B.R. 20:1691.—Common old garden plant, and worthy. Fls. scentless.

11. **aggregàta**, Spreng. (*Ipomópsis élegans*, Lindl.). Differs in mostly shorter stature and more slender habit, with redder (sometimes white) fragrant fls., with acute and reflexing corolla lobes. Neb., south and west. B.R. 15:1281.—Probably not in cult. The fls. are fiery scarlet or sometimes nearly white. A very showy biennial.

AA. *Lvs. opposite, entire, or, if alternate (as in No. 12) palmately parted.*

B. *Foliage very fine, the lvs. cut into thread-like or linear divisions.*

C. *Corolla rotate-bell-shape, with a short, flaring tube.*

12. **liniflòra**, Benth. (*G. linifòlia*, Hort.). Fig. 906. Ten to 20 in. high, diffuse and branchy: lower lvs. mostly opposite, but the upper alternate, all palmately divided to the base in needle-like or spurrey-like divisions: fls. rather large for the size of the plant, the corolla white or blush, nearly rotate, the thin lobes obtuse. Calif. B.M. 5895.—A useful tufty garden annual. The name *liniflora* is meant to designate the resemblance of the fls. to those of *Linum tenuifolium*; but some catalogue maker, evidently thinking that the name meant *linear-flowered*, and was therefore inappropriate or an error. has changed the name to *G. linifolia*, under which name it is known in the trade.

CC. *Corolla salver-form, with a filiform and elongated tube (Leptosiphon).*

13. **densiflòra**, Benth. (*Leptosiphon densiflòrus*, Benth.). Erect or even strict, 1–2 ft., hairy: lvs. with many filiform somewhat rigid divisions: fls. in rather close heads, lilac or white, ½–¾ in. long; tube of the corolla scarcely longer than the leaves; lobes of the corolla spreading, obtuse, often dentate, nearly or quite as long as the tube. Calif. B.M. 3578. B.R. 20:1725.—Common garden annual. The white-fld. form is known as var. **alba**, Hort.

14. **androsàcea**, Steud. (*Leptosiphon androsàceus*. Benth.). Much like the last, but the tube very slender and much exserted beyond the calyx and leaves: fls. 1 in. long, pink, lilac or white, in rather close heads, the corolla lobes ovate-acute and entire, much shorter than the tube, 12–18 in. Calif. B.M. 3491. B.R. 20:1710.

15. **micrántha**, Steud. Fig. 907. Tufted, 8 in. or less high, the stems most leafy near the top: lvs. short, fascicled: fls. with an exceedingly slender thread-like tube which is 1–1½ in. long, and projecting prominently above the upper fascicles of lvs., the corolla lobes spreading and obtuse; color range very wide,—from purple to lilac, red, yellow and white. Calif.—A popular and important bedding plant. Forms of it are known as *Leptosiphon aureus*, *carmineus*, *hybridus*, and *roseus*.

906. Gilia liniflora (×⅔).

907. Gilia micrantha (×½).

BB. *Foliage of entire (but narrow) lvs.*

16. **dianthoìdes**, Endl. (*Fénslia dianthiflòra*, Benth.). Fig. 908. Tufted, 6 in. or less high: lvs. narrowly linear, opposite: fls. 1–1½ in. long, lilac or purple, with yellowish throat, the flat-spreading lobes denticulate or

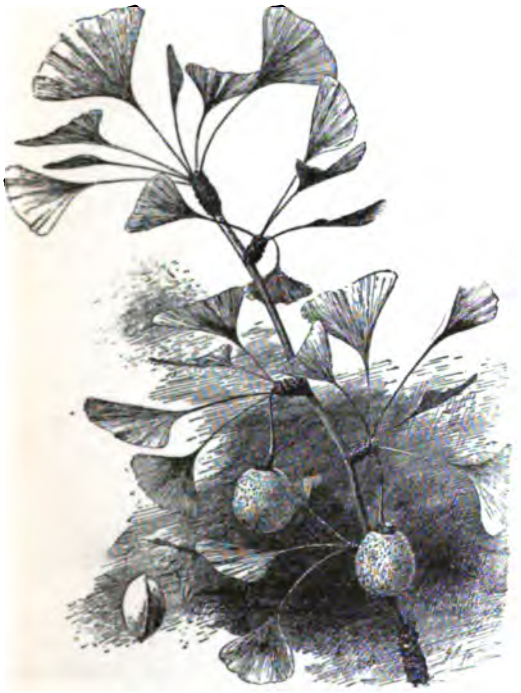
nearly fringed. S. Calif. B.M. 4876. R.H. 1865:10.—A choice little annual, excellent for edgings and rock-work, bearing a profusion of pink-like fls. The fls. sometimes vary to white (*Fenzlia alba*, Hort.). A large-fld. form is called *C. speciosa*. L. H. B.

908. Gilia dianthoides. The Fenzlia of gardens.

GILL. *Nepeta Glechoma.*

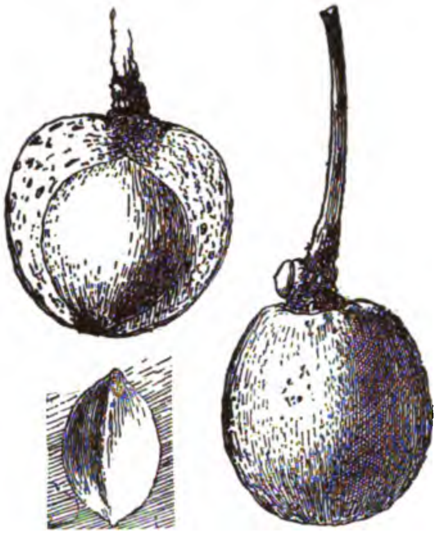
GILLÈNIA (a German physician of the seventeenth century, Arnoldus Gillenius). *Rosàceæ.* Two East American perennial herbs, with 3-foliolate nearly sessile lvs. and 5 long white or rose-tinged narrow petals, which are more or less unequal, 10–20 included stamens, 5-toothed calyx, and 5 2–4-seeded pods: fls. many in loose, terminal clusters in summer. To this genus Britton has recently given the name *Porterànthus* (*Porter's flower*, in honor of Dr. T. C. Porter), because Adanson had earlier made a genus Gillena. The species are **G. trifoliàta,** Mœnch (Bowman's Root), in rich woods from N. Y. to Ga. (Mn. 8:129. B.M. 489), and **G. stipulàcea,** Nutt. (American Ipecac), with a more southern range. The former has ovate-oblong serrate leaflets and small, mostly entire stipules: the latter has lanceolate deeply incised leaflets and leafy incised stipules, and is more pubescent. Gillenias are excellent, graceful plants for the mixed or hardy border. They are hardy and of easy culture in any good soil. 2–4 ft. tall. They propagate by seed and division. L. H. B.

GILLYFLOWER down to Shakespeare's time usually referred to what we now call the carnation, *Dianthus Caryophyllus*, also known as clove pink. Since Shakespeare's time Gilliflower has usually meant either wallflowers or stocks, as explained under *Cheiranthus* and *Matthiola*.


909. Ginkgo.

GINGER. *Zingiber officinale.* **Wild Ginger.** *Asarum Canadense.*

GÍNKGO (Chinese name). *Coniferæ*, tribe *Táxeæ*. One tree, with wedge-shaped lvs., fls. small and mostly diœcious. Pistillate fl. solitary, the single naked ovule ripening into a drupe. Staminate fls. in slender, loose catkins.


910. Ginkgo fruit and seed. Natural size.

biloba, Linn. (*Salisbùria adiantifòlia*, Smith). Ginkgo. Maidenhair Tree. Kew Tree. Figs. 909, 910. A tall, sparsely branched, usually slender tree, attaining a height of 60–80 ft.: lvs. 3–5, clustered, fan-shaped, divided at summit, with thickened margin, striated on both sides with numerous parallel veins: fls. diœcious; male catkins slender, stalked; females on long footstalks, in pairs, of which one usually aborts: fruit a drupe, consisting of an acrid, foul-smelling pulp surrounding a smooth, angular oval, cream-colored, thin-shelled, sweet-kerneled nut. Northern China. F.S. 10, p. 119. G.C. III. 5:265, 269. G.F. 1:175. A.G. 12:268. Gng. 6:194.

Introduced to America early in the century, and generally successful on good soil in the eastern states as far north as eastern Massachusetts and central Michigan and along the St. Lawrence river in parts of Canada. Of special value for solitary planting to secure picturesque effects. Considerably planted in Washington, D.C., where it is growing in esteem as a street tree because of its upright habit and freedom from insect injury. Easily propagated from seed, stratified in autumn; varieties by budding and grafting. Several horticultural forms are recognized, including *laciniata*, *pendula* and *variegata*.

The foul odor of the ripe fruits, which continue to mature and drop during a period of some weeks, constitutes the chief objection to the species as a street tree, or near dwellings, and suggests the advisability of propagating from staminate trees by grafting or budding, for planting in such locations. The kernels, which have a sweetish, slightly resinous flavor, are highly esteemed for food in China and Japan, and are gathered from fruiting trees in Washington for such use by Chinese laundrymen.

The word Ginkgo seems to be pronounced with a hard initial G in the orient, but in English a soft G should be used. The name is often spelled Gingko, but the other spelling is preferable because Linnæus spelled it so in the generic name. W. A. Taylor.

GINSENG (*Pànax quinquefòlium*, Linn. *P. Ginseng*, Meyer. *Aràlia quinquefòlia*, Decne. & Planch.) is to the Chinese more than quinine or any other drug is to Americans. As its name Panax implies, it is a panacea, being employed for all the ills that flesh is heir to. Though credited with stimulating, aromatic, alterative, carminative and tonic properties, the root is with us seldom used except as a demulcent. The reverence in which it is held, and the high price that it commands in China, led to extensive search for a substitute, which resulted in the discovery in 1716 of American Ginseng, *Panax quinquefolium*, near Montreal, Canada. This root was favorably received by the Chinese, and soon became an important article of export. During the past 40 years the price of American Ginseng has advanced nearly 700 per cent, but owing to the energetic hunt for the root, to the destruction of forests and to the gathering of plants at improper times, the wild supply has greatly decreased. With the advancing prices and the diminishing supply came experiments in Ginseng cultivation, most of which failed through ignorance of the plant's peculiarities. The seed ripens in Sept. If dry it will not germinate until the second year, but if fresh and properly kept nearly all the seeds will germinate the first season. The soil must be a light, friable loam, free from stones, etc., rich in humus and well drained; the plants must be well supplied with shade and moisture. Cultivated Ginseng already commands a considerably higher price than the wild root, and, though no returns can be expected from a plantation until it is 3 or 4 years old, the industry is found to be profitable by the men that have given it careful attention.

Ginseng beds can be located in orchards, gardens, or woods, where the roots may remain without danger of deterioration for several years after they first attain marketable size. The roots are so valuable that they are likely to be stolen, and beds should, therefore, be placed where they can be guarded. M. G. KAINS.

For further information on Ginseng, send to Div. of Publications, Dept. of Agriculture, Washington, D. C., for Bulletin No. 16 of the Div. of Botany, revised by M. G. Kains in 1898, or consult Kains' Ginseng, its cult., etc., Orange Judd Co., 1899. W. M.

GLADÌOLUS (diminutive of Latin *gladius*, a sword, from the shape of the lvs. of the first-described species). *Iridàceæ*. Gladioli are amongst the most popular of all garden plants, and particularly of the class known as summer-flowering bulbs, ranking in popularity with cannas, dahlias, lilies and iris, and having probably no other rivals. They are also the most important, commercially, of all the "Cape bulbs."

About 140 species of cormous herbs, which bear lily-form fls. in spikes at the summit of a scape. Fl. more or less tubular, the tube usually funnel-shaped (enlarging upwards); segments 6, more or less unequal, strongly narrowed or even clawed at the base, the upper ones often hooded or roofed over the opening or mouth of the flower; stamens 3, inserted on the tube; stigmas 3, on a long style: ovary 3-loculed. Fig. 911. Monogr. by Baker, Irideæ, pp. 198–229 (1892).

About 15 of the species are natives of Europe and western Asia. A few have been discovered on the mountains of tropical Africa. The larger part of the species are South African, however (Cape Colony and Natal), and of these species the habitat is not mentioned in the following synopsis. The Europe-Asian species are little cultivated in this country. Some of them are hardy. The S. African species, variously hybridized, have given rise to the numerous and excellent garden strains. There are semi-double forms. L. H. B.

I. THE CULTURE OF GLADIOLI.

A. *From the amateur's point of view.*

The essentials of Gladiolus culture can be told in a sentence: the corms should be planted as early in spring as the soil can be fitted; they flower the same season in July and August, and can be stored over winter in any cool, dry cellar that will keep potatoes. Late spring frosts do not penetrate the soil deep enough to hurt the early planted corms. The blooming season can be easily prolonged until frost by successive plantings from April to July 4. The flowers are excellent for cutting, and last a week in water. Some varieties need staking, but stakes are objectionable on general principles, even when neat and slender. Seedlings are easily raised, and the process is described in the next paragraph. Gladioli are easily forced to flower in November and December, as the corms can be kept dormant by the simplest kind of cold storage. It is common for florists to hold some corms in a cool place until August; then plant them in boxes of rich soil 4–5 in. deep, and keep the boxes outdoors until frost. After frost-time the corms are brought into a cool greenhouse, where they flower within two months. New corms form above the old one, and bloom the next season (Fig. 912). Cormels or "spawn" also form on offshoots: these bloom in two or three years. L. H. B.

AA. *From the commercial point of view.*

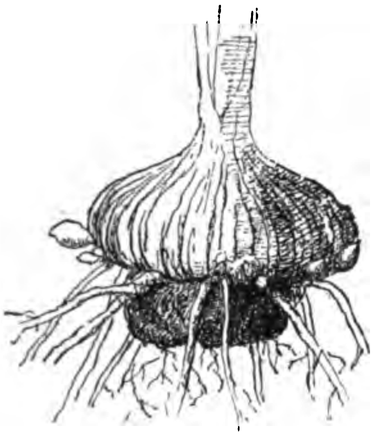
The culture of Gladioli is very easy, and can be conducted under nearly any of the conditions suitable for potatoes. Gladioli succeed best in a sandy loam which is retentive of moisture. For successful commercial culture it is essential that such soil conditions are obtainable. Planting should be commenced as early in the spring as the proper working of the soil will permit. Such preparation of the soil as puts it in a loose, friable condition will answer. Probably the ideal soil is a sod, fall plowed and then most thoroughly worked in the spring. Strong, fresh stable manure should be avoided. If soil is not sufficiently rich in plant-food it is best to use all strong manures on a previous season's crop of some other kind. Any complete fertilizer is beneficial when thoroughly worked through the soil, at the rate of 600 to 1,000 pounds per acre. The ground being prepared, it should be furrowed 4 in. deep and from 24 to 36 in. apart, according to method of cultivation. If fine, round bulbs are to be grown, and the stock for planting exceeds 1½ in. in diameter, it will be necessary to place the bulbs right side up in the furrow by hand, either in single or double rows 2 in. apart. Bulbs of lesser size can be scattered as evenly as possible along the furrow, with an average of 10 or 12 to the foot of furrow. Clean culture throughout the growing season is essential. Cutting the spike of flowers is a help to increasing the size of the bulbs. Four months is sufficient for the growth and maturity of the bulb. To harvest, loosen the soil and lift the bulbs by their tops, and lay on the ground to dry off and ripen. Should weather permit they can be entirely ripened out of doors. Cut the tops off close to the bulb, pulling off the old bulbs and roots, and place in thin layers in crates and store in a cool, dry place. If circumstances require, the tops can be trimmed off at once on lifting, and the bulbs taken under cover for cleaning and drying.

911. Parts of a Gladiolus flower.

Gladioli are increased in three ways: (1) by natural division from the parent corm; (2) by seed; (3) by the small corms growing at the base of the new corm.

In the first method all that is necessary is to separate the corms growing from the original, either when cleaning in the fall or before planting in the spring.

When seeds are sown, the seedlings should all produce corms of flowering size in 3 years. Seed should be planted very early in the open ground on rich, sandy soil and not allowed to suffer in the least for lack of moisture. At the end of the first season's growth the corms of the seedlings will be the size of peas, and can be stored under the same conditions as large corms. The second season plant the corms as if they were garden peas. Some will bloom the second year, and all should bloom the next.



912. Gladiolus corm growing above the old one. Also shows cormels.

Increasing stock by the small corms or bulblets is the most common method, and the one by which a variety is perpetuated. The small corm is but a cutting or eye, and can be stored in bags, boxes or other suitable receptacles and kept from frost. It is a help to sprouting if the corms are not allowed to dry out during the period of rest. They should be planted like 1-year seedlings, making blooming bulbs the first and second year.

E. H. Cushman.

AAA. *From the American hybridizer's point of view.*

The garden evolution of Gladioli in general is explained at length below. The writer has been asked to present the American share in this interesting history. Some ten years ago, when the writer began, under the inspiration of Luther Burbank, his own work in hybridization, the best American-grown stock available was the Hallock collection of some 400 named varieties of Gandavensis and about 100 of the earlier Lemoine hybrids, all of European origin. After trial, the writer placed them all in mixtures.

About this time Luther Burbank began to offer a few named varieties, but shortly afterwards sold his whole stock, the collection being now in the writer's hands. This collection, in the opinion of the writer, is the best strain of Gandavensis. The varieties were largely of variegated types, with many of unique markings and peculiar form. Burbank had given particular attention to varieties calculated to withstand the hot, dry winds of California, and had originated several with specially stiff petals, quite distinct from the ordinary types. The peculiarity of the flowers blooming around the spike like the hyacinth was also his contribution. All of his varieties are now grown in mixture by the writer with the exception of a white variety, which promises to be distinct and valuable for some time to come. However, the vitality of Burbank's strain is remarkable, and in the opinion of the writer it is greater than that of all the other strains of so-called American hybrids which constitute the principal stocks of commerce on this continent.

The latter strains have probably been largely produced from self-fertilized seed of European and American varieties, themselves the product of natural selection, thus carrying to their progeny the objection of a weak and degenerate parentage.

The work of Dr. Van Fleet, of New Jersey, was carried on more for scientific than commercial results, and reaped a deserved success. However, the writer has found that the offspring of a pure species is less stable than that of well-balanced cross-bred varieties, the former system handing down few varieties of permanent commercial value, though they are in themselves valuable as parents for the foundation of new strains.

The best work of a semi-professional character, in the opinion of the writer, has been done by T. S. Moore, of Indiana, who has spared no trouble or expense in procuring choice material upon which to build, and with satisfactory results. As to *G. cruentus* (a strain of reds), the writer thinks that little is to be gained by its use, as we have too many reds already. Its roots tend in this climate to early and rapid degeneration.

The writer believes that the beauty of the individual flower is the highest ideal, though vigor of plant and vitality of variety are also necessary. He regards the Gladiolus as a cut-flower rather than a garden plant, and believes higher satisfaction is gotten from cutting the spike when the first bud opens than from leaving the flowers to open outdoors.

A new strain of great interest is composed of the hybrids of the *G. Papilio*, var. *major*, a most interesting species in which the under color, a unique shade of blue, is overlaid with dull terra-cotta. In seedlings raised by the writer these colors have separated, producing the most beautiful heliotrope and clematis blues and rich velvety purples, colors quite unknown in the older sections.

Another strain likely to be presented soon is the product of the old species *G. dracocephalus*. The flowers of the hybrids are covered with minute dots similar to those of the species. The species and its hybrids have exceptional vigor and vitality.

Gladioli are most adaptable to all soils, providing reasonable assistance is given. Clean, sandy loam is preferable, fertilized at least every other autumn with well-rotted manure, which is carefully covered below the depth of planting. Before spading or plowing the ground it is well to dress freely with fresh, hardwood ashes. On heavy clay use leached ashes freely, and cover deeply all the green vegetable refuse and leaves that have been partially rotted under the manure pile since the previous autumn. Also fill in the trenches with sand or loam. In swamp muck and vegetable deposit, a mixture of sand added yearly is all that is needed, the trenches being filled with sand at planting. Cold, springy swamp lands with the water half filling the trenches at planting, have given perfect satisfaction with blooming bulbs, that have been developed on the other soils. Water should be freely used during the season of active growth; moderately with blooming stock before budding in order to ripen the plant; then again freely before the buds show color and until after blooming. Full exposure to the sun and air is necessary for the best results.

H. H. Groff.

II. THE KINDS OF GLADIOLI.

alatus, 2.
angustus, 5.
atroviolaceus, 7.
biflorus, 8.
blandus, 22.
Brenchleyensis, 27.
Bride, 26.
Byzantinus, 13.
cardinalis, 17.
Childsii, 30.
Colvillei, 26.
communis, 12
concolor, 4.
crispiflorus, 6.
dracocephalus, 19.
floribundus, 23, 26.
Frœbeli, 31.
Gandavensis, 27.
grandis, 3.
Leichtlini, 16.
Lemoinei, 28.
Milleri, 25.
Nanceianus, 29.
nanus, 26.
Natalensis, 20.
oppositiflorus, 24.
Papilio, 15.
psittacinus, 20.
purpureo - auratus 21.
Quartinianus, 9.
ramosus, 26.
Saundersii, 18.
segetum, 14.
sulphureus, 10.
trimaculatus, 5.
tristis, 4.
Turicensis, 32.
versicolor, 8.
vinulus, 11.
vittatus, 11.
Watsonius, 1.

Other Latin names are in the trade, but they are mostly or wholly garden forms.

I. *Species.*—Few of the original species of Gladioli are in cultivation in their pure form. When grown at all, they are prized chiefly as oddities, or because of their botanical interest. The following species are either offered at the present time in American trade or are parents of modern garden forms :

A. *Fl. with a long, slender, cylindrical curved tube, which is enlarged in the middle : segments nearly equal.*

1. **Watsònius**, Thunb. Corm small, globose : stem slender, 18 in. or less, with 1 long, narrow-linear and stiff leaf and 2–3 short, sheathing lvs.: fls. 2–4, in a lax 1-sided spike, 2 in. or less long, bright red, the wide-spreading segments oblong and acute. B.M. 450.—Little known in this country, but offered by the Dutch growers.

AA. *Fl. short and open, the tube short or scarcely any; segments very prominently clawed, usually unequal.*

2. **alàtus**, Linn. Small, the stem only 4–8 in. high, and slender : lvs. 3–4, linear and rigid: fls. 3–4 in a lax spike, the curved tube ½ in. long, the perianth bright red and often strongly veined; segments very unequal, the 3 lower tongue-like and protruded, the others obovate or nearly orbicular, all of them differently colored toward the base. B.M. 586 ; 592 (the var. *Namaquensis*).

AAA. *Fls. of medium length, with a funnel-shaped tube, which is flaring at the top: segments narrowed below, but not distinctly clawed. (Gladiolus proper.)*

B. *Lvs. linear (½ in. or less wide)—except sometimes in Nos. 9, 10.*

C. *Perianth-segments acute.*

3. **grándis**, Thunb. (*G. versicolor*, André). Stem slender, 2 ft. or less : lvs. about 3, linear or nearly terete, strongly ribbed : fls. 6 or less, 3 in. long, with a curved tube ; segments nearly equal, oblong-lanceolate and cuspidate, as long as the tube and twice longer than the stamens, recurved and often wavy, yellowish or creamy, tinged and striped with purple-brown : seeds winged. B.M. 1042.

4. **trístis**, Linn. Very like the last: fls. 2–4, somewhat smaller ; segments shorter than the tube and not twice longer than the stamens, acute, yellowish white with purple or brown pencilings, or (in *G. concolor*, Salisb.), almost white or uniform yellow. B.M. 272, 1098. G.F. 8:75.

5. **angústus**, Linn. (*G. trimaculàtus*, Lam.). Small and slender species (10–20 in. tall): lvs. 3–4, very narrow : fls. 2–6, long-tubed, white, the oblong segments shorter than the tube and the 3 lower ones with a characteristic purple median line ending in a heart-shaped mark. B.M. 602.

CC. *Perianth-segments obtuse.*

D. *Color purple or violet.*

6. **crispiflòrus**, Herb. (*G. imbricàtus*, Linn., var. *crispiflòrus*, Baker). Stem 1–2 ft., rather slender: lvs. 2–3, sometimes ½ in. broad : fls. 4–10, the tube ¼ in. long and curved, the segments obovate (1 in. long), crisped or wavy on the edge, dark purple, more or less marked with white and red: seeds winged. E. Eu. and W. Asia.—Hardy or nearly so.

7. **atroviolàceus**, Boiss. Stem 1–2 ft. high: lvs. 3, closely ribbed, firm: fls. few, the tube ½ in. long and curved, the obovate segments 1 in. long and dark purple or violet-blue : seeds globose. W. Asia.—Hardy or nearly so.

8. **biflòrus**, Klatt. Dwarf (1 ft. or less): lf. single, very narrow: fls. 2–3, the tube nearly straight, the oblong segments twice as long as the tube, lilac.

DD. *Color essentially yellow or orange.*

9. **Quartiniànus**, Rich. Strong, 2–4 ft.: lvs. 3–4, rigid, sometimes nearly ensiform: fls. 4–9, in an open spike, large, the narrow curved tube 1½ in. long; upper segments hooded, the others smaller and more or less reflexed, bright yellow or yellow flushed and feathered with scarlet. B.M. 6739. G.C. III. 24:467, and Gn. 55:1225 (var. *superbus*) Mts. of Trop. Afr.—Not known to be in the Amer. trade, but attracting attention in Europe. One of the best of the genus.

10. **sulphùreus**, Baker. Stout, but low: lvs. 3–4 the blade short and somewhat ensiform: fls. 6–8, large, the curved tube 1½ in. long, soft bright yellow; upper segments cucullate, the 3 lower ones small. Mt. Kilimanjaro. Gn. 38:762(?)

DDD. *Color (under color) white or nearly so.*

11. **vittàtus**, Hornem. (*G. vinulus*, Klatt). Low: lvs. 3–4, very narrow: fls. 3–6, nearly erect, the slightly curved tube nearly or quite an inch long, whitish, the 3 lower segments with a purple central blotch.

BB. *Leaves ensiform (½ in. or more broad, and flat or flattish).*

C. *Under- or body-color essentially purple.*

12. **commùnis**, Linn. Stem 1½–2½ ft.: lvs. 3–4, 1 ft. or less long: fls. 4–8, small (1½ in. long), with a curved tube ; segments bright purple (flesh-colored in the var. *carneus*), nearly equal in length, all connivent or touching (making a narrow fl.), the 3 lower ones long-clawed and with a median line : seeds broad-winged. France, Germany. B.M. 86, 1575.—Hardy. Little known in cult. in this country.

13. **Byzantinus**, Miller. Fls. more and larger, plant more robust, segments more spreading at maturity, although the 3 upper ones are contiguous, dark purple, the 3 lower ones with a prominent white median line : seeds winged. Mediterranean region. B. M. 874.—Hardy. Little known in gardens.

14. **segètum**, Ker. Differs from *G. Byzantinus* in having globular (not winged) seeds, and in the flaring or spreading segments of the bright purple, obovate-obtuse sepals. Canaries and Mediterranean region. B.M.719.—Hardy. Little grown. Early.

15. **Papilio**, Hook. Stem 2 ft. or often more : lvs. about 4, rigid, 1 ft. or more long: fls. 6–12, with a curved tube, pale purple or lilac, yellow in the throat; upper segments obovate and hooded, 1½ in. long, the lower ones very narrow below and marked with large red-brown blotches. B.M. 5565.—Handsome. Varies to white in cult.

CC. *Under- or body-color essentially red (No. 20 may be sought here).*

16. **Leichtlini**, Baker. Stem about 2 ft. tall, terete : lvs. about 4, 1 ft. long : fls. 6–8, large, with a curved tube 1¼ in. long, crimson and yellow; upper segments obovate and connivent, 3 lower ones much smaller and acute, spreading, red at tip but yellow and minutely red dotted below.

17. **cardinàlis**, Curt. Tall: fls. many, nearly erect, bright scarlet, the tube 1½ in. long and nearly straight; upper segments long-spatulate (2 in. long), scarlet, the 3 lower ones shorter and narrower, with a large white blotch. B.M. 135.

18. **Saùndersii**, Hook. f. About 2 ft.: lvs. 4–6, strongly ribbed and stiff: fls. 6–8, large, bright scarlet, the tube 1 in. to 1½ in. long and curved ; 3 upper segments long-spatulate, uniform scarlet, connivent (2 in. long), 3 lower smaller, white-blotched and spotted. B.M. 5873. Gn. 12:83.—Handsome.

913. Gladiolus Gandavensis. (×½.)

occ. *Under- or body-color essentially yellow.*

19. **dracocéphalus**, Hook. f. Stem stout, 2 ft. or less: lvs. 3–4, rather firm: fls. 3–6, of medium size, yellowish green, the tube (2 in. or less long) curved; upper segments elliptic-obovate and more or less hooded, yellowish and closely striate with purple, the other segments much smaller and reflexing, mostly green and purple spotted. B.M. 5884.—Odd.

20. **psittacinus**, Hook. (*G. Natalénsis*, Reinw.). Stem 3 ft. high, stout: lvs. about 4, rather rigid: fls. many and large, with a curved tube nearly or quite 2 in. long, rich yellow but thickly grained and overlaid with red (particularly about the margins of the segments); upper segments obovate and hooded, the lower much smaller and reflexing. B.M. 3032. B.R. 17:1442. L.B.C. 18:1756.—One of the leading parents of garden Gladioli.

21. **purpùreo-auràtus**, Hook. f. Stem 3–4 ft., very slender: lvs. 3–4, short: fls. 10 or more, primrose-yellow, medium in size, the curved tube less than 1 in. long; segments obovate, not widely spreading, the lower ones with a purple blotch. B.M. 5944. G.F. 2:89.—Handsome. A parent of modern Gladioli.

cccc. *Under- or body-color white.* (*Forms of No. 15 may be sought here.*)

22. **blándus**, Ait. Stem 2 ft. or less tall: lvs. usually 4: fls. few, white and red-tinged, the curved tube 1½ in. long; segments all oblong or oblong-spatulate and flaring or recurved, some of them red-marked in the throat. Variable. Sometimes pure white (B.M. 648), and sometimes flesh-color (B.M. 645).—An old garden plant.

23. **floribúndus**, Jacq. Stem short (1 ft.), producing fls. from near its base: lvs. usually 4: fls. 12 or less, large, white tinged with pink, the slightly curved tube 2 in. or less long; segments obovate or spatulate, obtuse, wide-flaring, red-lined. B.M. 610.

24. **oppositiflòrus**, Herb. Much like the last, but fls. more numerous and smaller, in a distichous (or 2-sided) spike, white, sometimes marked with rose. B.M. 7292 G.C. III. 13:291. Gn. 45:963.—A very handsome plant growing 3–6 ft. high, and producing spikes 2 ft. long.

25. **Milleri**, Ker-Gawl. Stem 12–20 in.: lvs. about 4: fls. rather large, 4–5, nearly erect, milk-white, the tube 2 in. or less long and nearly straight; segments oblong and nearly acute. B.M. 632.

II. *Hybrids.*—The garden Gladioli are hybrids of various kinds and degrees. Of many, the parentage is so confused that it cannot be made out. However, there are four main lines of development or divergence, represented in the late-flowering Gandavensis, Lemoinei and Nanceianus, and the early-flowering Colvillei. An important article on the hybridizing of Gladioli, by Robert T. Jackson, will be found in G.F. 2:88.—Some of the points of merit of the modern Gladiolus are: good constitution; good substance or texture of flower; brilliancy and definiteness of color; large size; long spikes (20–25 blooms).

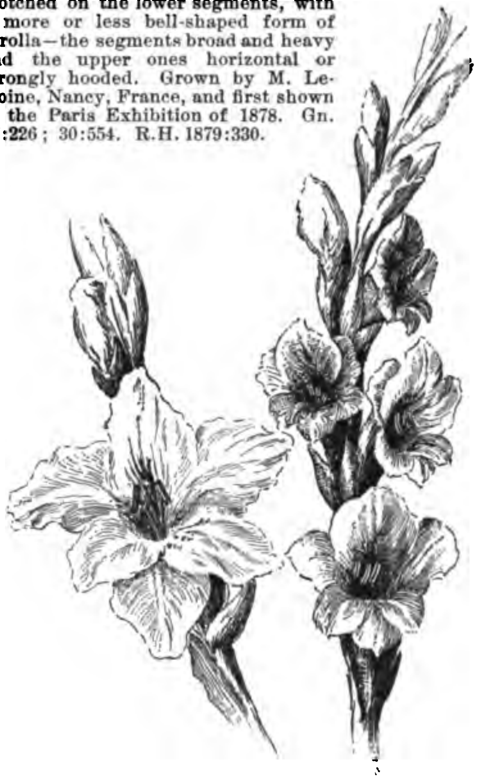
26. **Cólvillei**, Sweet (*G. cardinalis* × *tristis*). Fls. open or flaring, with oblong-acute segments, scarlet, with long blotches at the base of the lower segments: early-flowering: spikes short. Hardy south of Washington with some protection. R.H. 1895, p. 289. G.C. III. 12:90. Gn. 28:520; 34:680; 50, p. 66.—The oldest of the garden forms.

Runs into many types and strains. The modern white-flowered type, represented by The Bride, is best known in this country. Small forms are known as *G. nanus*. Some forms are known as *G. floribundus*.

Another form of early-flowering Gladioli is known as *G. ramòsus*, Paxt. (issue of *G. cardinalis* and *oppositiflorus*), but it is probably no longer possible to distinguish these two groups.

27. **Gandavénsis**, Van Houtte (*G. psittacinus* × *cardinalis*). Fig. 913. Upper segments nearly or quite horizontal or hooded, the colors in bright shades of red and red-yellow, variously streaked and blotched: late-flowering: spikes long. The commonest old-time type of garden Gladiolus. F.S. 2:84 (1846). R.H. 1846:141. P.M. 11:27.—First offered to the trade by Van Houtte, Aug. 31, 1841. M. Souchet, of Fontainebleau, France, did much to improve the Gandavensis type by repeated selections and breeding. By Herbert and some others, Gandavensis is considered to be an offspring of *G. psittacinus* × *oppositiflorus*. *C. Brenchleyénsis* is one of the Gandavensis tribes.

28. **Lemóinei**, Hort. (*G. Gandavensis* × *purpureo-auratus*). Fig. 914. A modern race characterized by highly colored yellow, red and purplish fls., purple-blotched on the lower segments, with a more or less bell-shaped form of corolla—the segments broad and heavy and the upper ones horizontal or strongly hooded. Grown by M. Lemoine, Nancy, France, and first shown at the Paris Exhibition of 1878. Gn. 17:226; 30:554. R.H. 1879:330.



914. Gladiolus Lemoinei (on the right), and G. Nanceianus.

29. **Nanceiànus**, Hort. (*G. Lemoinei* × *G. Saundersii*). Fig. 914. Robust, with very large, open-spreading fls., the two side segments widely flaring and sometimes measuring 6–8 in. from tip to tip; upper segment long and upright. First exhibited by Lemoine, the raiser, in 1889. The finest race, characteristically is full-open and large fls., in brilliant shades of red and purple. Gn. 41:846. G.C. III. 13:131.

30. **Childsii** (*G. Gandavensis* × *Saundersii*). Fls. similar to *G. Lemoinei* in shape and color. Originated by Max Leichtlin, Germany.

31. **Frœbeli**, Hort., is *G. Gandavensis* × *G. Saundersii*, var. *superbus*.

32. **Turicénsis**, Hort., is of like parentage. G.F. 3:89.—This and the last are the work of Frœbel & Co., Zurich. They are of recent origin.

L. H. B.

GLADWIN. *Iris fœtidissima.*

GLASS. The important subject of greenhouse glass is treated under *Greenhouse Glass.*

GLASSHOUSE. Any glass structure in which plants are grown, particularly one which is large enough to admit the operator. It is a generic term. See *Greenhouse.*

GLASSWORT. *Salicornia.*

GLAÚCIUM (name refers to glaucous foliage). *Papaveràceæ.* HORNED POPPY. A dozen or more herbs of S. Eu. and W. Asia; annuals, biennials or occasionally perennials, a few of which are grown for their large poppy-like fls. and glaucous-blue foliage. Sepals 2: petals 4: stamens many: ovary with 2 (rarely 3) cells, the stigmas miter-shaped, the fruit becoming a long silique-like capsule: lvs. alternate, lobed or dissected. Glauciums are low, branchy herbs, often somewhat succulent, with large fls., mostly yellow or orange, but varying to red and purple. The fls. are usually short-lived, but they are borne in rapid succession. They are well adapted for foliage effects in borders or edgings. Of easy culture in any good soil. They prefer an open, sunny situation. Mostly prop. by seed, but the perennial kinds by division; however, the perennials are short-lived, and usually had best be treated as biennials; they should be grown from seed.

915. Glaucium luteum.

lùteum, Scop. (*G. flàvum*, DC.). Figs. 915, 916. Stems stout, 1–2 ft., pubescent: radical lvs. 2-pinnate and hairy, the upper clasping and sinuate-pinnatifid: fls. generally solitary, on long stems, 2–3 in. across, yellow or orange. Eu.—Sparingly naturalized E. Perennial or biennial; sometimes grown as an annual.

corniculàtum, Curt. (*G. phœniceum*, Gaert. *G. rùbrum*, Hort.). Lower: radical lvs. pinnatifid, pubescent, the upper ones sessile and truncate at the base: fls. red or purplish, with a black spot at the base of each petal. Eu.—Mostly annual. *G. Fischeri*, Hort., is probably a form of this.

L. H. B.

GLAZIÒVA. See *Cocos insignis.*

GLÉCHOMA. See *Nepeta.*

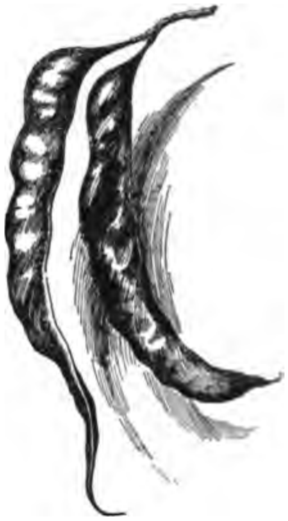
GLEDÍTSCHIA (after Gottlieb Gleditsch, director of the botanic garden at Berlin; died 1780). Syn *Gleditsia*. *Leguminòsæ*. HONEY LOCUST. Ornamental deciduous trees, often with large branched spines on trunk and branches: branches spreading, forming a broad graceful rather loose head, with finely pinnate foliage, generally light green and turning clear yellow in fall; the greenish fls. appearing in racemes early in summer are inconspicuous, but the large, flat pods are ornamental and the fertile tree is therefore to be preferred for planting. *G. triacanthos* is a useful native. *G. Japonica* and *G. ferox* are almost hardy North. They are very valuable trees for park planting and for avenues, and make almost impenetrable hedges if planted thickly and pruned severely. The coarse-grained wood is durable and strong. The pulp of the pods of *G. triacanthos* is sweet when fresh, hence the name Honey Locust, but becomes bitter at length; in Japan it has been used as a substitute for soap. The Gleditschias are of vigorous growth and thrive in almost any soil. Prop. by seeds sown in spring about 1 in. deep, they should be soaked in hot water before being sown; varieties and rare kinds are sometimes grafted on seedlings of *G. triacanthos* in spring. About 10 species in N. America, Asia and Africa. Lvs. alternate, abruptly pinnate, often partly bipinnate on the same leaf, or wholly bipinnate, both usually on the same tree: fls. polygamous; calyx lobes and petals 3–5, stamens 6–10: pod compressed, mostly large and indehiscent, 1–many-seeded.

916. Glaucium luteum (× ⅓).

A. *Pod thin-walled: lvs. pinnate with more than 12 lfts., or bipinnate.*

triacánthos, Linn. HONEY or SWEET LOCUST. THREE-THORNED ACACIA. Fig. 917. Tree, 70–140 ft., usually with stout simple or branched spines 3–4 in. long: lvs. 6–8 in. long, with pubescent grooved rachis; pinnate with 20–30 lfts., bipinnate with 8–14 pinnæ; lfts. oblong-lanceolate, remotely crenulate-serrate, ¾–1⅓ in. long: fls. very short-pedicelled in 1⅓–3 in. long, narrow racemes: pod 12–18 in. long, slightly falcate and twisted at length. May, June. From Pa. south to Miss., west to Neb. and Tex. S. S. 3:125, 126.—Var. **inérmis**, DC. Unarmed or nearly so, of somewhat more slender and looser habit. Var. **Bujòti**, Hort. (*G. Bujòti péndula*, Hort.). With slender, pendulous branches and narrower lfts.

Japónica, Miq. Tree, 60–70 ft., with somewhat compressed, often branched spines, 2–4 in. long: lvs. 10–12 in. long, with grooved and slightly winged, puberulous rachis, pinnate with 16–24 lfts., bipinnate with 8–12 pinnæ; lfts. ovate to oblong-nearly lanceolate, obtuse, entire or remotely crenulate, lustrous above, ¾–2 in. long: fls. short-pedicelled, in slender racemes: pod 10–12 in. long, twisted, bullate, with the seeds near the middle; pulp acid. Japan, China. G.F. 6:165.—Var. **purpùrea**, Rehd. (*G. Sinénsis*, var. *purpùrea*, Loud. *G. coccínea*, Hort. *G. Sinensis*, var. *orientàlis*, Hort.). Lfts. broadly oval to oblong-oval, obtuse or emarginate, ⅓–1⅓ in. on the pinnate, smaller on the bipinnate lvs.



917. Gleditschia triacanthos. (× ⅓.)

fèrox, Desf. Tree, with compressed, large, usually branched spines: lvs. with grooved, almost glabrous rachis, usually bipinnate; pinnæ 6–10, with many lfts.; lfts. ovate-lanceolate to lanceolate, acute, minutely and remotely crenulate, ⅓–1⅓ in. long. China. Often cult. under the name *G. macracantha*, *Sinensis* var. *Japonica* and *horrida* and usually referred to *G. Sinensis*, but seems more closely allied to *G. Japonica*. Var. **nàna**, Hort., is a shrubby, often less spiny form.

AA. *Pod thick-walled: lvs. pinnate, with 4–12 lfts., rarely bipinnate.*

Sinénsis, Lam. Tree, to 40 ft., with stout conical often branched spines: lvs. 5–7 in. long, with grooved pubescent rachis, and 8–18 lfts.; lfts. ovate or oblong-ovate, obtuse or acute, crenulate-serrate, reticulate beneath, ¾–2 in. long: fls. distinctly pedicelled, in slender racemes: pod almost straight, thick, 4–7 in. long, 1–1⅓ in. broad. China.

G. aquática, Marsh. (G. monosperma, Walt. G. inermis, Mill., not Linn.). WATER or SWAMP LOCUST. Tree, to 60 ft., with mostly simple spines: lvs. pinnate, with 12–18 ovate-oblong, crenulate lfts., or bipinnate, with 6–8 pinnæ: pod thin, elliptic, 1-seeded, 1–2 in. long. From Carolina south, west to Texas. S.S. 3:127–28.—*G. austràlis*, Hemsl. Tree with large spines: lfts. very oblique, oblong, crenate leathery, shining: pod with coriaceous walls, 4–5 in. long. S. China.—*G. Cáspica*, Desf. Allied to G. triacanthos. Lvs. pinnate with 12–20 ovate, crenulate lfts., or bipinnate with 6–8 pinnæ: pod thin, pulpy, to 12 in. long.—*G. Fontanèsi*, Spach. = G. macracantha.—*G. hórrida*

Willd.—G. Sinensis.—*G. macracántha*, Desf. Allied to G. Sinensis; spines and lfts. generally larger: pod 4–6 in. long, ¾ in. broad, often almost cylindrical. China.

Alfred Rehder.

GLEICHÈNIA (W. F. Von Gleichen, 1717–1783). *Gleicheniàceæ*. A genus of about 30 species of ferns from the tropical and south temperate zones, growing naturally in dense thickets. The leaves fork, often several times, and the family is characterized by dorsal sori composed of a few nearly sessile sporangia; these are surrounded by a broad transverse ring, and open vertically. The species after the third are often catalogued under Mertensia, a name which, because used for a genus of flowers, must give way to Dicranopteris if they are separated and placed in a distinct genus, where they probably belong.

A. *Ultimate lobes small, roundish.*

B. *Sorus of 3–4 sporangia, superficial.*

rupéstris, R. Br. Lobes rounded or obtusely quadrangular, the margins thickened and recurved, somewhat glaucous beneath. Australia. Var. **glaucéscens**, Moore, has lvs. of thicker texture, which, when young, are very glaucous on both sides, contrasting with the reddish purple stalks.

circinàta, Sws. Lobes ovate or rotund, with the rachides pubescent when young; 3–5 times forking, the ultimate pinnules 1 in. long. Austral., New Zealand.

Var. **spelúncæ**, Hort. (*G. spelúncæ*, R.Br.). Lvs. pendent but not curving; pinnules curved inward, forming small cavities. Var. **semivestita**, Labill. (*G. semivestita*, Hort.), differs in its close and very erect habit, and flat, deep green pinnæ. Var. **Méndelli**, Moore (*G. Méndelli*, Hort.). More robust and compact than the type, with flat, thicker and glaucous lvs. Gn. 51, p. 472.

BB. *Sorus of 2 sporangia concealed in slipper-shaped lobes.*

dicárpa, R.Br. Lvs. 2–4 times forked, with the lobes strongly arched, rotund or narrow, with the under surface rusty-hairy. Australia.

AA. *Ultimate lobes pectinate: sori near the middle of the veinlets.*

C. *Leaf, after first forking, bipinnate.*

glaùca, Hook. Primary branches elongate, 2–3 ft. in length; rachises with rusty scales; pinnæ 4–8 in. long, with closely placed entire segments, glaucous beneath. China and Japan.

CC. *Leaf with fan-shaped divisions.*

flabellàta, R. Br. Lvs. 2–3 times forked, the divisions ascending, 6 in. or more long, elliptic-lanceolate; ultimate divisions linear. Australia.

longipinnàta, Hook. Branches of the lvs. repeatedly dichotomous; pinnæ up to 2 ft. long, 3 in. wide. Trop. America.

AAA. *Ultimate branches with a pair of forked pinnæ: leaf stems zigzag, repeatedly dichotomous.*

dichótoma, Willd. With a distinct pair of pinnæ arising from the base of the forked branches; segments not decurrent. Tropical regions generally, but several species have been confused here, as in many of the widely distributed species.

L. M. Underwood.

GLÓBBA (Malayan name). *Scitaminàceæ*. This genus, which belongs to the same family with the cannas and ginger plant, contains some herbaceous conservatory plants with rhizomes and habit of canna, and a singular floral structure. Only one species is known to be cult. in America. This is known to the trade as *G. coccinea*, which is really *G. atrosanguinea*, figured at B.M. 6626. Index Kewensis is clearly in error in referring *G. coccinea* to *G. albo-bracteata*, as is plain from G.C. II. 18:71. Veitch introduced in 1881 a plant under the provisional name of *G. coccinea*, as it was supposed to be a new species, but the next year it was identified with *G. atrosanguinea*. This plant was highly praised in 1893 by John Saul, who said substantially: "Plants in bloom the greater part of the year: stems much crowded, 12–18 in. long, gracefully arching on all sides: fls. scarlet and yellow, in dense racemes." The credit for the discovery of this plant is generally given to F. W. Burbidge, but in G. C. II. 18:407 Burbidge gives the honor to Curtis. For culture, see *Alpinia*.

atrosanguinea, Teijsm. & Binnend. (*G. coccinea*, Hort., Veitch). Stem slender, becoming 2–3 ft. high: lvs. 3–4 in. long, elliptic, acuminate at both ends; sheaths purplish, pubescent, closely clasping the stem: lower flowerless bracts distant, brown, 6–9 lines long: upper and flowering bracts crowded, red: fls. 1⅙ in. long; corolla yellow, tubular, thrice as long as calyx. Borneo. B.M. 6626.

W. M.

GLOBE AMARANTH. *Gomphrena.*

GLOBE FLOWER. See *Trollius.*

GLOBE HYACINTH. Consult *Muscari.*

GLOBE MALLOW. See *Spæralcea.*

GLOBE THISTLE. See *Echinops.*

GLOBE TULIP. See *Calochortus.*

GLOBULÀRIA (the flowers in small, globular heads). *Globulariàceæ*. About a dozen species of Old World herbs, subshrubs and shrubs, with small blue fls. mostly in globular heads. Lvs. from the root, or alternate, leathery, entire or with a few sharp teeth. Probably the commonest and best species is *G. tricosantha*, which thrives at the front of well-drained borders, but is particularly showy in the rockery. For this and *G. vulgaris* and its forms, J. B. Keller advises rather moist but well-drained soil and partial shade. Prop. by division or seed.

A. *Hardy herbaceous plants about 6–12 in. high.*

B. *Root-lvs. 1-nerved.*

trichosántha, Fisch. & Mey. Height 6 in.: root-lvs. spatulate, 3-toothed at apex; stem-lvs. obovate or oblong, mucronate, sessile. July, Aug. Asia Minor. Syria.—"Lvs. turn blackish purple in fall."—*Woolson.*

BB. *Root-lvs. 5-nerved.*

vulgàris, Linn. Height 8–12 in.: root lvs. obovate, petiolate, nearly entire, apex entire, notched or mucronate: stem-lvs. lanceolate, sessile. S. Eu., Caucasus. July, Aug. B.M. 2256.

AA. *Tender subshrub.*

Alypum, Linn. Lvs. obovate-oblong, mucronate or 3-toothed at apex. Mediterranean regions.—Cult. in S. Calif. by Franceschi, who says it is covered with fls. all winter. Also cult. abroad under glass.

W. M.

GLORIÒSA (Latin for *glorious*). Syn., *Methónica*. *Liliàceæ*. Three tropical species, all African, and one also Asian. They are tall, weak-stemmed plants, supporting themselves by means of tendril-like prolongations of the alternate, lanceolate or lance-ovate lvs.: fls. many and showy, long-stalked, borne singly in the axils of the upper lvs.; perianth of 6 distinct long segments, which are undulate or crisped, and reflexed after the manner of a Cyclamen, variously colored; stamens 6, long and spreading, with versatile anthers: ovary 3-loculed; style long, and bent upward near the base. Odd and handsome plants, to be grown in a warm house. They are not difficult to grow. The brightest fls. are produced in sunlight. The plants grow from tubers. These tubers should be rested in early winter, and started in pots in January to March. The plants bloom in summer and fall. When potting the old tubers, offsets may be removed (when they occur) and grown separately for the production of new plants. The tubers may be cut in two for purposes of propagation. Let the plants stand near a pillar or other support. Give freely of water when the plants are growing. In this country they are sometimes bedded out in summer. W. E. Endicott cultivates Gloriosa outdoors in summer at Canton, Mass., and finds that the plants so treated are not much inclined to climb and flower as freely as under glass. In Florida, they may be grown permanently in the open. Success with Gloriosa depends on having strong bulbs. Consult *Bulbs*.

A. *Segments (or petals) much crisped.*

supérba, Linn. Climbing Lily. Stem 5–10 ft. high: lvs. ovate-lanceolate; segments 3–4 in. long and less than an inch wide, opening yellow, but changing to yellow-red and deep scarlet. Africa, Asia. B.R. 1:77. Gn. 38:784. R.B. 23:121.

AA. *Segments somewhat undulate, but not crisped.*

simplex, Linn. (*G. viréscens*, Lindl. *G. Pldntii*, Loud.). Fls. opening yellow, and remaining so in shade, but becoming deep yellow-red when exposed to the sun; wider than in *G. superba*, barely undulate and wavy, and not prolonged or hooked at the end as in the latter species. Africa. B.M. 2539. Var. **grandiflòra,** Nichols. (*Methónica grandiflòra*, Hook.), has fls. 8 in. across. B.M. 5216.

G. Abyssínica, Rich., said to be the largest-fld. species, seems not to be in cult. L. H. B.

GLORY OF THE SNOW. Fanciful name for *Chionodoxa*.

GLORY PEA. See *Clianthus*.

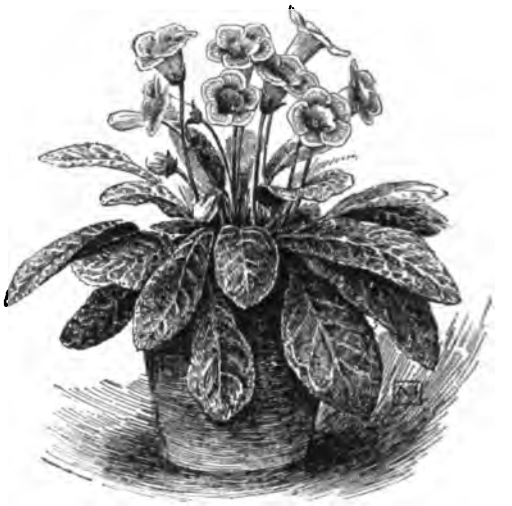
GLOXINÈRA. Name given to hybrids of Gloxinia (Sinningia) and Gesneria. See *Gloxinia*.

GLOXÍNIA. The genus Gloxinia was founded by L'Heritier in 1785 (named in honor of P. B. Gloxin, a botanist of Strassburg) upon *G. maculata* of Brazil. Early in this century a related Brazilian plant was introduced, and it attracted much attention: this plant was named *Gloxinia speciosa* by Loddiges in his Botanical Cabinet in 1817, and it was there figured. In the same year it was figured by Ker in the Botanical Register, and also by Sims in the Botanical Magazine. Sims wrote that the plant was "already to be found in most of the large collections about town [London]." These writers refer the plant to the Linnæan class Didynamia, but Ker also suggests that it may belong to the Campanulaceæ. This *Gloxinia speciosa* was the forerunner and leading parent of the garden Gloxinias, plants which are now referred to the family Gesneraceæ; but it turns out that the plant really belongs to Nees' genus Sinningia, founded in 1825 on a Brazilian plant which he named *S. Helleri*. All our garden Gloxinias are Sinningias, but to gardeners they will ever be known as Gloxinia; therefore, we will trace the evolution of them here.

Gloxinia has no tubers: Sinningia has. Gloxinia has a ring-like or annular disk about the ovary: Sinningia has 5 distinct glands. The Sinningias are either stemless or stem-bearing, with a trumpet-shape or bell-shape 5-lobed and more or less 2-lipped corolla, a 5-angled or 5-winged calyx, 4 stamens attached to the base of the corolla, and with anthers cohering at the tips in pairs, and a single style with a concave or 2-lobed stigma. The garden Gloxinias belong to the subgenus Ligeria (subgenus of Sinningia), which has a short stem or trunk, and a broad-limbed bell-shaped flower.

The true Gloxinias are not florists' flowers, and they are little known in cultivation. They are apparently not in the American trade. The old *G. maculata* is figured in the Garden 39:801 (p. 364), and it is probably to be found in choice collections in the Old World. It produces knotty rootstocks, which, as well as the leaves, may be used for propagation. It is also figured in B.M. 1191. *G. glabràta*, Zucc., from Mex., is the *G. glabra*, Hort., *Achimenes gloxiniæflora*, Forkel, and *Plectopoma gloxiniflorum*, Haust. It is a stemmy plant, with white fls. with yellow-spotted throat. (B.M. 4430, as *G. fimbriata*, Hort.) Plectopoma is now referred to Gloxinia. A few forms of this were once offered by Saul, but, with the exception of *P. gloxiniflorum*, they are probably all garden forms.

The garden Gloxinias (genus *Sinningia*) are nearly stemless plants, producing several or many very showy bell-like fls. each on a long stem. *Gloxinia speciosa* originally had drooping fls., but the result of continued breeding has produced a race with fls. nearly or quite erect (Figs. 918, 919). The deep bell of the Gloxinia is very rich and beautiful, and the erect position is a decided gain. The fls. also have been increased in size and number, and varied in shape and markings; the lvs. also have become marked with gray or white. The color of the original *Gloxinia speciosa* was apparently a nearly uniform purple. The modern races have colors in white, red, purple and all intermediate shades: some are blotched, and others are fine-spotted or sprinkled with darker shades. It is probable that the larger part of the evolution in the common greenhouse Gloxinia is a direct development from the old *G. speciosa*, but hybridity has played an important part. One of the earliest recorded series of hybrids (1844) was with *Sinningia guttata*, which is a plant with an upright stem and bearing rather small spotted fls. in the axils of the lvs. (B.R. 13:1112). The issue of this cross showed little effect of the *S. guttata*, except a distinct branching habit in some of the plants (B.R. 30:48). It is possible, however, that *S. guttata* has had something to do with the evolution of the spots on the present-day flower, although the original *G. speciosa* was striped and blotched in the throat. The student who wishes to trace some of the forms of garden Gloxinias may look up the following portraits: B.M. 1937, speciosa itself; B.M. 3206, var. albiflora; B.M. 3934, var. macrophylla variegata; B.M. 3943, var. Menziesii; F.S. 3:220, Zeichleri (hybrid); F.S. 3:268; F.S. 4:311, Fyfiana (hybrid); F.S. 6:610; F.S. 10:1002; F.S. 14:1434–6; F.S. 16:1699 and 1705; F.S. 17:1768, 1772–1776; F.S. 18:1846, 1878, 1885, 1918–19; F.S. 19:1955, double forms; F.S. 21:2164; F.S. 22:2324. I.H. 42:39, 41. Gt. 47:79; Gt. 48, p. 80. Gn. 15:168; 43:909; 52, p. 268. R.H. 1846:301, Teuchlerii; R.H. 1848:201, Fyfiana; 1877:70, variabilis; R.H. 1883, p. 248. For florists' plants, see A.F. 11:7; A.G. 14:49; Gng. 6:83. There are many Latin-made names of garden Gloxinias, but the plants are only forms of the *G. speciosa* type. One of the commonest current trade names is *G. crassifolia*, a name applied to some of the best and largest-growing strains.


918. Gloxinia of the florists.

There are double forms of Gloxinia, in which an outer but shorter corolla is formed. These forms are more curious than useful. Gloxinia (Sinningia) has been hybridized with Gesneria; and the hybrid progeny has been called Gloxinera (G.C. III. 17:145, Fig. 22). L. H. B.

Gloxinias are general favorites with most people. Their large tubular and richly colored blossoms, together with their soft, velvety green leaves, make a gorgeous display when in flower. Being natives of tropical America, they require stove temperature during their growing season. Though they may be grown so as to flower at almost any season of the year, yet they are naturally summer-flowering plants, and do best when treated as such. They are propagated by seeds, or by cuttings made of leaves or stems. Seeds are preferable, unless one wishes to increase some very choice colored variety, when it is best to propagate by leaf cuttings, using partly matured medium sized leaves with a small portion of leaf-stalk attached (Fig. 629, p. 423). These may be inserted in an ordinary propagating bed, where, if kept rather on the dry side, they will soon root and form tubers, when they may be potted and grown on. Seeds should be sown in a warm temperature early in February, in pans or shallow boxes containing a finely sifted mixture of peat, leaf-mold and silver sand in about equal proportions. The seedlings will begin to appear in about ten days, when great care must be exercised in watering, or they will "damp-off," as gardeners term it. In fact, success with these plants throughout the year depends largely upon the care exercised in watering. Even in their most active growth the water always should be given from the spout of a watering can, taking care not to wet the leaves, though they like a warm, humid atmosphere during their growing season. As soon as the seedlings can be conveniently handled, they should be potted singly into thumb pots and grown on rapidly, using in subsequent shifts a mixture of two parts leaf-mold, 1 part good fibrous loam and 1 part peat. The plants must be well shaded from sunlight and placed in a position free from draughts. The seedlings should begin to flower by the middle of August, when they should be given an abundance of air. After flowering, the leaves will begin to mature, when water should be gradually withheld. As soon as the leaves have all ripened off, the pots should be stored away in some convenient place for the winter, in a temperature of about 45°, giving just sufficient water to keep the tubers from shriveling. Towards the middle of February the tubers will show signs of starting into growth. A batch should be started at this time, choosing the tubers which appear most active, and the remainder should be held back for another month; this will give a much longer period of blossoming. The tubers should have all the old soil shaken off and be potted again in clean, well drained pots, using sizes just large enough to accommodate the tubers, the compost being the same mixture as before recommended. They should be given but little water until active root growth commences. As soon as the pots are filled with roots, they should be shifted on at once into the pots they are intended to flower in, as frequent shifts would more or less damage their leaves, which have a tendency to cling round the sides of the pots. The first batch should come into flower in June. When carefully grown, Gloxinias are particularly free from insect pests or fungous diseases, and the same tubers can be grown for several years. EDWARD J. CANNING.

919. Modern Gloxinia blooms (× 1/3).

As Gloxinias are essentially tropical plants, they require a temperature of 60° (night) if started early; yet seedlings raised during summer time do splendidly when planted in coldframes. When a select collection is desired, it is customary to plant hundreds of seedlings in frames for the summer. A large majority of these will bloom, from which a number of the best is selected. In connection with this method of culture, it is interesting to note that nearly all the plants which fail to bloom are strong growers, making grand specimens the following season, and the majority of them will be purple-flowered. The more upright-growing plants of red and pink shades are the first to bloom; and curiously, also, the latest plants to start of any age are generally the best. Although cultural directions usually insist on care in watering so as to avoid wetting the foliage, we have never been careful to follow these instructions closely, except when the plants are coming into bloom, but we realize that it might be detrimental in moist, dull weather. The greatest objection we have to wetting the foliage is on account of sediment from the water making a deposit on the bright, hairy foliage, taking away the luster which gives such a healthy and effective appearance to well-bloomed plants. T. D. HATFIELD.

GLYCÈRIA. Referred to *Panicularia*.

GLYCÌNE (Greek for *sweet*). *Leguminòsæ*. Perhaps 15 or 20 species in tropical Asia, Africa and Australia, mostly twining vines. The Glycines are allied to Dolichos, Vigna and Phaseolus: the cult. species are distinguished by small and hairy fls. in short axillary racemes; stipules very small and free from the petiole: leaflets (3) large and thin: seeds short or globular and pea-like. In this country Glycine is known only in the Soy Bean, **G. híspida**, Maxim. (Fig. 195, p. 137), which is an erect, hairy annual from Japan and China. It is also known as the Soja Bean, Coffee Bean and Coffee Berry. It grows 2–4 ft. high, making a rank, bushy herb, and bearing axillary clusters of small hanging, hairy pods, with constrictions between the seeds. The seeds are nearly globular, pea-like, usually white (*e*, Fig. 191, p. 136). In China and Japan the beans are much used for human food, but in this country the plant is grown for forage, having begun to attract attention about 25 years ago. The beans may be used as a substitute for coffee; and for this purpose the plant is often sold. The Soy Bean, in the form in which we know it, seems to be unknown in a wild state. It is probably a domesticated form of **Glycine Sòja**, Sieb. & Zucc., which is wild in Japan. These two species are united by some authors and separated by others (see Franch. & Sav. Fl. Jap. 1:108. Maxim. Bull. Acad. St. Petersb. 18:398). For purposes of perspicuity and definition, they may well be kept separate in the books. The Soy Bean has also been separated as a distinct genus under the name of *Soja hispida*, Mœnch; but this disposition is now mostly given up. For the economic merits of Soy Beans, see various experiment station reports; also Farmers' Bull. 58, U. S. Dept. of Agric. It has been recommended as a drought-resisting crop.

Glycine was once applied to Wistaria. It is sometimes used for that genus at the present day in foreign lists. L. H. B.

GLYCYRRHÌZA (Greek, *sweet root*). *Leguminòsæ*. LICORICE, also spelled LIQUORICE, and LICKORICE. This genus contains the plant whose roots produce the Licorice of commerce. Seeds in pods are listed by a few dealers with miscellaneous agricultural seeds. The genus has about a dozen widely scattered species of perennial herbs, often glandular: lvs. odd-pinnate; lfts. of indefinite number, rarely 3, entire, with minute glands or teeth: fls. blue, violet, white or yellowish, in axillary racemes or spikes, which are peduncled or sessile.

glàbra, Linn. Height 3–4 ft.: lfts. ovate, subretuse, subglutinous beneath: spikes peduncled, shorter than the lvs.: fls. distant: pods glabrous, 3–4-seeded. Summer and autumn. W. M.

The roots of Glycyrrhiza, a native of southern Europe and central Asia, are used extensively by druggists; in America by brewers and manufacturers of plug tobacco; in Turkey, Egypt and France to make cooling drinks. Our supply—more than one and a half million dollars' worth in 1899—is derived mainly from Spain, Portugal, Italy, Turkey and Russia (Transcaucasia), the roots from Spain and Italy being considered best, and those from Turkey poorest on account of their bitterness. The soil for Licorice must be deep, mellow, moist, rich and free from stones. Plants are usually set in rows, 3 ft. or more apart, and not less than 1 ft. asunder. After the plants have covered the ground, they are allowed to shift for themselves for 3 or 4 years. Harvesting is primitive, the roots being exposed by the plow and pulled by hand. Large quantities of roots are thus left to produce a succeeding crop or to overrun the field as weeds. One ton to the acre is considered a fair yield; 1.6 cents a pound an average price. In America the only fields worthy the name are in California, where Licorice is not considered very paying. Experiment and experience with it are, however, but little more than begun.

M. G. Kains.

GLYPTOSTRÒBUS. See *Taxodium*.

GMÉLINA (after one of five distinguished German botanists named Gmelin). *Verbenàceæ.* Eight species of E. Asiatic and N. Australian trees and shrubs, bearing yellow or brownish irregular fls. sometimes nearly 2 in. across. A very few plants may be cult. in European warmhouses, and in America only in S. Fla. and S. Calif. outdoors. The genus produces a fancy timber similar to teak, which is a product of the same order. Vitex and Clerodendron are better known congeners. Spiny or not: shoots tomentose: lvs. opposite, entire, toothed or lobed: fls. in panicled cymes, tomentose at least while young; corolla tube slender below; limb oblique, 5- or 4-lobed; stamens 4, didynamous.

A. *Lvs. becoming 9 in. long, 6 in. wide.*

arbòrea, Roxb. (*G. Rheèdii,* Hook.). Unarmed tree, sometimes attaining 60 ft., deciduous, flowering with the young lvs.: lvs. cordate-ovate. India, Malaya. B.M. 4395. Cult. only in S. Calif. by Franceschi, who keeps *G. Rheedii* separate.

AA. *Lvs. ½–1½ in. long.*

Asiática, Linn. (*G. parviflòra,* Pers., a typographical error for *G. parvifòlia,* Roxb.). Shrubby, sometimes spinescent: lvs. ovate or obovate, entire or lobed. India, Ceylon.

GNAPHÀLIUM. See *Leontopodium* and *Helichrysum.* There are various native Gnaphaliums, but they are not in cultivation. *G. lanatum* of gardeners is *Helichrysum petiolatum.*

GOAT'S BEARD is usually *Spiræa Aruncus;* also the genus Tragopogon, to which the Salsify or Oyster Plant belongs.

GOAT'S FOOT. *Oxalis Caprina.*

GOAT'S RUE. See *Galega.*

GOBO. See *Burdock.*

GODETIA. Included in *Œnothera.*

GOLDEN CHAIN. *Laburnum vulgare.*

GOLDEN CLUB. *Orontium.*

GOLDEN DEWDROP. Fanciful name for *Duranta Plumieri.*

GOLDEN FEATHER. See *Chrysanthemum parthenioides.*

GOLDENROD. *Solidago.*

GOLDEN SEAL. *Hydrastis.*

GOLD FERN. *Gymnogramma*

GOLDFUSSIA. Included in *Strobilanthes.*

GOLD THREAD. *Coptis trifolia.*

GOMBO, Gumbo, or Okra. See *Hibiscus esculentus.*

GOMPHRÈNA (name suggested by *Gromphræna,* Pliny's name for some Amaranth, supposed to be derived from *grapho,* to write or paint; alluding to the highly colored or "painted" foliage). *Amarantàceæ.* This genus includes the Globe Amaranth, a common everlasting flower of easy culture. It is also known as Bachelor's Button, though two other utterly distinct plants (*Centaurea Cyanus* and *Ranunculus acris*) have the same popular name. The flower-heads are an inch or less in diameter, globose, of many colors, and chiefly remarkable for the showy bracts, which hide the true flowers. In a family remarkable for brilliant foliage this genus seems to be the only one valued for everlastings. Nearly all the other everlasting flowers of importance belong to the Compositæ. Gomphrena has about 70 species, mostly in the warmer parts of America and Australia, but the Globe Amaranth is widely dispersed throughout the tropics. Herbs erect or prostrate, pubescent to villous, with or without a leafy involucre: fls. short or long, white or colored: bracts short or long, concave, and keeled, winged or crested on the back. For culture, see *Annuals* and *Everlasting Flowers.*

globòsa, Linn. Globe Amaranth. Bachelor's Button. Height 18 in. or less: lvs. elliptic to obovate, the largest 4 in. long, 1½ in. wide, tapering to a petiole. July. B.M. 2815. R.H. 1890, p. 522. F.R. 1:333. The following names of horticultural varieties indicate the range of color: vars. **álba, aúrea, cárnea, nana compácta** (=alba), **purpùrea, striàta, violàcea.** Dwarf and compact forms are likely to be associated with any color. There is a narrow-leaved form of this species which Voss calls **G. Haageàna,** Kl. (*G. aurantiàca,* Hort. *G. coccínea,* Decne.), which has lanceolate lvs., often 6 times as long as broad. The lvs. are rarely ½ in. wide. R.H. 1854:161. All are easily grown annuals.

G. gnaphalioides, Vahl. See Pfaffia.

W. M.

GONANIA is a typographical error in some nursery catalogues for *Gouania.*

GONGÒRA (after Don Antonio Caballero y Gongora, Bishop of Cordova). Includes *Acropera. Orchidàceæ,* tribe *Vándeæ,* subtribe *Cyrtopodièæ.* A small genus of plants with curious spotted fls., not common in cultivation, and of little value except for collections. Distinguished from the other members of the subtribe by being epiphytic, having the dorsal sepal adnate to the column, and by its many-fld. raceme. Dorsal sepal erect, spreading, thus appearing to spring from the base of the column; lateral sepals spreading or reflexed from the base of the column, wider; petals small, adnate to the base of the column; labellum continuous with the column, narrow and fleshy, with 2 thick lateral horned or aristulate lobes, and a central one which is saccate or even folded, forming a vertical plate: column erect or ascending, not winged: pseudobulbs sulcate, sheathed, bearing 1 or 2 large, plicate lvs.: fls. borne in a long, loose, pendent raceme arising from the base of the pseudobulbs.

Gongoras are extremely free-flowering, and grow easily in a mixture of sphagnum and peat, with a little charcoal added for drainage. During the growing season they require plenty of water, and brisk heat. In the winter they require little water, but should be kept in a moist atmosphere in a cool, shaded house. They grow well with Cattleyas, or in a temperature of 60° in winter and 80° in summer. Some growers prefer to use fine fern root packed tightly and for a top finish a little fine moss found in damp meadows, instead of sphagnum, which in this climate is quick to decay.

A. *Lateral sepals ovate or oblong, truncate.*

truncàta, Lindl. Pseudobulbs deeply furcate: lateral sepals rotund, oblong, truncate, the upper one ovate, keeled; petals minute, ovate; sepals and petals pale straw color, spotted with purple; base of labellum compressed in the middle, 2-horned: apex ovate, canaliculate. B.R. 31:56.

AA. *Lateral sepals broad, ovate, pointed.*

B. *Fls. light sepia brown: ovary much incurved.*

galeàta, Reich. f. (*Maxillària galeàta*, Lindl. *Acropèra Lóddigesii*, Lindl.). Pseudobulbs ovate-conical, clothed with membranous scales: lvs. broadly lanceolate, 6 in. long: racemes drooping, 6–8 in. long, with 6–12 pale sepia brown fls.: dorsal sepal galeate; petals small, oblong-truncate; labellum 3-lobed; lateral lobes inflexed, middle one saccate. The plants bear several short, rather large-fld. racemes. Aug. Mex. B.M. 3563. L.B.C. 17:1645.

BB. *Fls. yellow: ovary somewhat incurved.*

Armeniaca, Reichb. f. (*Acropèra Armenìaca*, Lindl.). Pseudobulbs ovate, sulcate, 2-lvd.: raceme loose, bearing many yellow fls.: sepals ovate, rounded, apiculate, the lateral ones oblique; petals one-half as long as the column; labellum fleshy; apex ovate, plane, acuminate, base tuberculate, crested. B.M. 5501.

AAA. *Lateral sepals lanceolate to ovate-lanceolate.*

B. *Fls. chocolate-brown, spotted.*

atropurpùrea, Hook. Pseudobulbs oblong-cylindrical, deeply sulcate, 2-lvd.: lvs. about 1 ft. long, lanceolate, subplicate: racemes numerous, 2 ft. long, bearing many chocolate-colored, spotted fls. about 2 in. in diam.: margins of the sepals revolute; petals small, twisted at the apex; labellum 4-horned at the base; apex folded so as to form a vertical triangular plate. This species is the most common in cultivation. It is nearly always in flower during the summer. Trinidad. B.M. 3220.

BB. *Fls. yellow, spotted.*

quinquenérvis, Ruiz & Pavon (*G. maculàta*, Lindl.). Pseudobulbs ovate-oblong, deeply furrowed, 2-lvd.: lvs. broadly lanceolate, 5-plaited: racemes many, 2 ft. long, with numerous yellow fls. spotted with dark red: lateral sepals reflexed, meeting in the back; petals small, linear-oblong, from the middle of the column; lip 4-horned at base; apex folded, tapering to a setaceous point. A curious plant, much resembling *G. atropurpurea* except in color and form of fls. May–Aug. B.M. 3687., B.R. 19:1616.

BBB. *Fls. dull red-purple spotted, with a yellow labellum.*

tricolor, Reichb. f. (*G. maculàta*, var. *tricolor*, Lindl.). Pseudobulbs ovoid, 2½ in. long, deeply furrowed: lvs. ovate-oblong, acuminate, about 5-ribbed, 6 in. long: raceme slender, pendulous, lax-fld., 6–10 in. long: pedicels with ovary 1½–2 in. long, speckled like the rachis: fls. about 2 in. long: dorsal sepals lanceolate, with revolute margins, tip recurved: lateral sepals ovate-lanceolate, with revolute margins, dull red-purple, with a pale, stout midrib: free portion of the petal spreading, upcurved, lanceolate, speckled: labellum golden yellow, base cuneiform saccate, truncate in front, with an awn on each side, apical part broadly funnel-shaped, with a spurlike, slender, speckled tip, gibbous behind: column slender, speckled. B.M. 7530. B.R. 33:69.

G. fuscàta, Hort. (Acropera fuscata and luteola, Hort.), has been cult. for many years, but no description is available.

H. HASSELBRING and WM. MATHEWS.

GONIÒMA (Greek, *gonia*, angle, corner; the corona cornered near the top). *Apocynàceæ.* A monotypic genus containing a South African shrub. John Saul, of Washington, D. C., spoke of it as having racemes of double white fls., borne on the point of every shoot, and suggesting the Cape Jessamine by their form and fragrance. He probably had some other plant in mind, for, according to DeCandolle, Gonioma has yellowish fls., only a third of an inch long, borne in cymes which are shorter than the lvs., the lvs. being 1¾–2 in. long. Saul also advertised "*Tabernæmontana Camelliæflora pleno* Glory of the Day," which may have been a variety of the common *Tabernæmontana coronaria*. Gonioma differs from Tabernæmontana in having the ovules arranged in 2 series instead of an indefinite number of series.

Kamássi, E. Mey. (*Tabernæmontàna Camássi*, Regel). Height 16–20 ft.: lvs. opposite or the upper ones in 3's, oblong-lanceolate, entire, leathery, 4–6 lines wide: cymes small, terminal, 8–10-fld.: fls. salver-shaped, yellowish, 3 lines long; tube a little wider at the middle and angled, constricted at top, pilose within from the middle to the top; lobes a third as long as the tube, ovate, cordate, twisted to the right in the bud; style 2-cut.

GONIOPHLÈBIUM. A subgenus of Polypodium, with anastomosing veins; by some regarded as a genus. For *G. subauriculatum*, see *Polypodium.*

GONIÓPTERIS (Greek, *angled fern*). *Polypodiàceæ.* A genus of tropical ferns allied to Phegopteris, with naked rounded sori and the lower veinlets of contiguous segments or lobes united. By some placed under Polypodium.

crenàta, Presl. Lvs. 1–2 ft. long, on stalks nearly as long, with a terminal pinnæ 6–8 in. long, often 2 in. wide, and 4–8 similar lateral pinnæ; margins bluntly lobed; sori near the main veins. Cuba and Mexico to Brazil.

L. M. UNDERWOOD.

GOOBER is a commoner name in the South than "Peanut," which is the universal name in the North. For culture, see *Peanut;* for botany, see *Arachis.*

GOÒDIA (after Peter Good, who found the plant in N. S. Wales). *Leguminòsæ.* An Australian genus of 2 species of shrubs, with pea-like fls., chiefly yellow, but with red markings. Both species have long been cult. in a few conservatories abroad, but the pubescent species is now forgotten and the glabrous one, in America is cult. chiefly in S. Calif. outdoors. Under glass these shrubs are treated like Cape heaths or Australian hard-wooded plants. The genus has no near allies of garden value. It belongs with 4 other Australian genera to the sub-tribe Bossiæa, in which the lvs. are mostly simple: stamens coalesced into a sheath, which is split above: seeds strophiolate. From these 4 genera Goodia differs in having 3 leaflets, and its racemes terminal or opposite the lvs. instead of axillary.

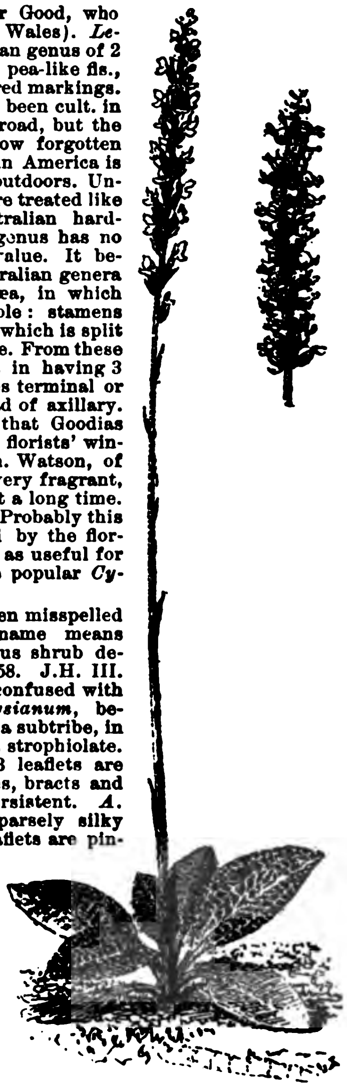
A. Schultheis writes that Goodias are occasionally seen in florists' windows in America. Wm. Watson, of Kew, says the fls. are very fragrant, and remain on the plant a long time. He adds (G.F. 2:244): "Probably this plant, if taken in hand by the florists, would prove quite as useful for spring flowering as the popular *Cytisus racemosus.*"

lotifòlia, Salisb. Often misspelled "latifolia," but the name means "lotus-leaved." Glabrous shrub described above. B.M. 958. J.H. III. 29:484.—Likely to be confused with *Argyrolobium Andrewsianum*, belonging to the Crotalaria subtribe, in which the seeds are not strophiolate. In Argyrolobium the 3 leaflets are digitate and the stipules, bracts and bractlets small but persistent. *A. Andrewsianum* has sparsely silky lvs. In Goodia the 3 leaflets are pinnately arranged, and the stipules, bracts and bractlets very evanescent.

W. M.

GOOD-KING-HENRY. Consult *Chenopodium.*

GOODYÈRA (after John Goodyer, British botanist, who helped Johnson in his edition of Gerarde's Herbal



920. Goodyera pubescens.

Orchidàceæ, tribe *Neottièæ*. This genus includes the Rattlesnake Plantain and a few other dwarf terrestrial orchids of minor importance which are cult. chiefly for their variegated foliage. They grow a few inches high, with scapes 8-15 in. high at most. About 25 species. Lvs. radical, usually reticulately veined: fls. in dense or loose spikes; labellum saccate; anther on the back of the column.

A. *Hardy native plants.*

B. *Labellum strongly inflated, with a short tip.*

pubéscens, R. Br. RATTLESNAKE PLANTAIN. Fig. 920. Lvs. ovate, deep green; veins netted, white: scape stout: spike dense, ovate in outline before anthesis: fls. globular, whitish; beak of stigma short, obscure. Aug. N. F. to Fla., west to Mich. and Minn. L.B.C. 1:1. B.B. 1:474. Mn. 2:54. F.S. 15:1555. A.G. 12:281 and 13:520. Should be grown in ordinary loam mixed with pine needles and dry pine twigs. Not well suited for greenhouse cult.

BB. *Labellum saccate, with an elongated tip.*

C. *Beak of the stigma shorter than its body.*

rèpens, R. Br. Lvs. ovate to oblong-lanceolate; veins dark: spike 1-sided: labellum with a recurved tip. L.B.C. 20:1987. B.B. 1:474. Rhodora, 1, plate 1. Var. **ophiòdes**, Fernald (Fig. 921), is the commoner form of this species, with very broadly marked lvs.

CC. *Beak as long as or longer than the stigma.*

tesselàta, Lodd. (*G. pubéscens*, var. *minor*). Lvs. broadly ovate to oblong-lanceolate; venation exceedingly variable: scape slender: spike loose: fls. white; labellum less saccate than in *G. repens*; tip straight. B.M. 2540. L.B.C. 10:952. Rhodora 1, plate 1. Confused by tradesmen with the next. —Should be planted out in a rockery in shade, the roots being firmly placed among dead pine needles and loam. Referred by Index Kewensis to *G. pubescens*.

BBB. *Labellum scarcely saccate, margin involute.*

Ménziesii, Lindl. Plant rather large: veins netted: spike somewhat 1-sided. Western U. S. to northern N. Eng. B. B. 1:475. — Advertised by Dutch dealers.

AA. *Tender exotics, cult. under glass.*

B. *Lvs. with a whitish midvein.*

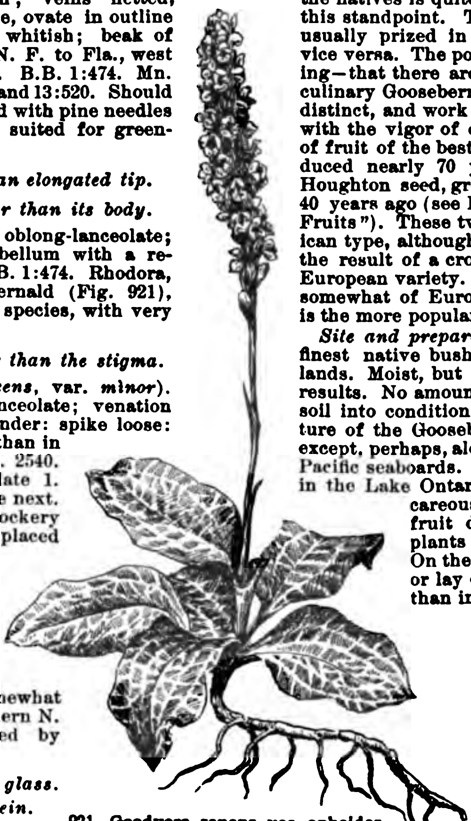
velùtina, Maxim. Fls. whitish, tinged rose. Japan. F.S. 17:1779.

BB. *Lvs. with white, netted veins.*

Schlechtendalliàna, Reichb. f. (*G. Japónica*, Blume). In general appearance like *G. tesselata*. Lvs. ovate: spike loose: fls. white. Japan.—Once advertised by Pitcher & Manda.

G. Dawsoniàna and *G. discolor*. See Hæmaria.—*G. quercicola*. See Physurus.

OAKES AMES.



921. Goodyera repens, var. ophoides. Spike denser than common.

GOORA NUT is a name for the *Cola*.

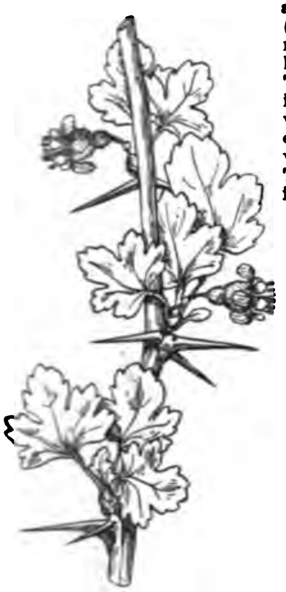
GOOSEBERRY. The Gooseberry and the currant are two of the hardiest types of bush fruits. The native forms range far north into British America (see *Ribes*). Seedlings of these are also very hardy. English varieties are comparatively tender. The Gooseberry appears not to have been cultivated for more than 300 years. There was, however, a remarkable increase in the number of varieties in England between 1650 and 1750. The Gooseberry became a favorite fruit with the Lancashire weavers, who should be credited with this great development. Miller, 1731, says it would be useless to attempt an enumeration of varieties. In America the Gooseberry has been a neglected fruit. With wild forms in abundance, types greatly superior to those from which the immense English varieties were derived, with a crying need for better table varieties, practically nothing has been done to improve the natives. Our natives have not been improved primarily because the American people have never acquired or cultivated a taste for the fresh fruit of the Gooseberry. In England the fruit of many of the large, fine-flavored varieties is used uncooked. In America the fruit of the Gooseberry is thought of only in connection with pie (tart) or jam, and when transformed into these food products, flavor, while of some importance, is but a minor consideration. The claim that English Gooseberries are less palatable than the natives is quite true, when passed upon from this standpoint. The best cooking apples are not usually prized in the raw state on the table, and vice versa. The point is this—and it is worth making—that there are dessert Gooseberries and also culinary Gooseberries. We should keep the classes distinct, and work for the production of varieties with the vigor of our natives and quality and size of fruit of the best European. Houghton was produced nearly 70 years ago, and Downing from Houghton seed, grown by Charles Downing, about 40 years ago (see Bailey,"Evolution of our Native Fruits"). These two varieties represent the American type, although it is possible that Downing is the result of a cross between Houghton and some European variety. The habit of the plant partakes somewhat of European characteristics. Downing is the more popular.

Site and preparation of soil.—The largest and finest native bushes are found upon rich bottom lands. Moist, but not soggy, clay loams give best results. No amount of fertilizing will bring sandy soil into condition suitable to the successful culture of the Gooseberry anywhere in this country except, perhaps, along the north Atlantic and north Pacific seaboards. Good results have been secured in the Lake Ontario fruit region on reddish, calcareous clay. In such situations the fruit does not drop easily, and the plants are usually free from mildew. On the east and west coasts the aspect or lay of the land is of less importance than in the interior. In the mid-continental region a sharp, north slope on a cool, clay loam ridge is essential to the fullest success. A clover sod turned under and thoroughly worked up is an excellent preparation for the Gooseberry plantation. A heavy preparatory application of barnyard manure may tend to make the soil too porous and too easily dried out. If applied the season previous to setting the plants, and the land is cropped with potatoes, it will be left in good condition to receive the Gooseberries.

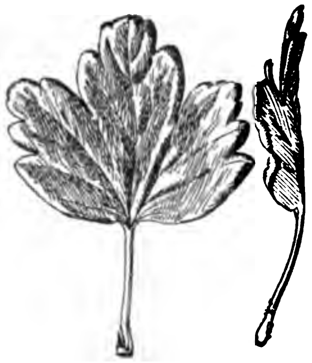
Gooseberries, particularly the English kinds, will endure more shade than most fruit plants, provided the soil is suitable. Good results are often secured by planting in rather densely shaded city gardens. Where these conditions prevail, special attention should be paid to maintaining an open head, in order to discourage the growth of mildews.

Planting and training.—The Gooseberry vegetates at a low temperature. It should, therefore, be planted as soon as the ground can be worked in spring. A better plan is to plant early in autumn. It may be transplanted successfully as early as August 15 south of latitude 42 degrees, and north of that line from September 1 up to the beginning of frosty weather. When set out late in autumn, the surface of the ground should be thoroughly mulched with straw or manure. The English varieties grow somewhat larger than the American type, and require rather more space. The plants are variously distanced, according to the inclination of the grower; 6 x 3, 5 x 3, and 4 x 4 ft. apart for garden culture are the commoner distances at which the plants are set.

The training of the Gooseberry is exceedingly simple. It bears most freely on 2- and 3-year-old wood. The aim should be to keep a continuous supply of vigorous shoots. As they become enfeebled, cut them out. Encourage spurring by cutting back when a variety indulges in a rambling habit, like Josselyn (Red Jacket). In the East, it is recommended to thin the head to lessen the tendency to mildew. This is probably good advice, but in the West it does not apply with the same force; rather cut out the weaker branches, and prevent mildew by other methods. Thin, also, to facilitate fruit picking. Prune to encourage upright growth, when cultivating varieties like Mountain Seedling and Houghton. The bush form, with several stems, is to be preferred to the single stem; plantations last longer in bush form, and are more productive.



922. Ribes Grossularia in bloom. Nat. size.



923. Leaves of Ribes Grossularia. Natural size.

Tillage and fertilizing.—In the east and west coast climates, and in the lake region, clean culture may be given; but in the interior, mulching with strawy manure or barnyard litter is better than mulching with soil. Cool, rich soil constitutes an essential to success. Good results have been obtained by the use of coal ashes as a mulch. This is, of course, only an amateur's method, and not feasible on a commercial scale. The Gooseberry is grown with a fair degree of success between young orchard trees on the loose soils bordering the upper waters of the Mississippi and Missouri rivers. The practice is not to be commended from the standpoint of the welfare of the orchard. Gooseberries are also grown between grape rows—a practice hardly to be commended. Practice only shallow tillage.

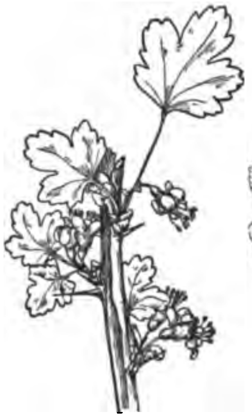
Picking, marketing, and conserving.—Picking Gooseberries is an uncomfortable and generally uncongenial occupation. The best native varieties, as a rule, are those most completely armed with thorns. A little practice, however, will enable a dexterous picker to secure the berries without receiving much punishment in return. The berries cluster along the lower side of the bearing branch. They are best removed by elevating and steadying the branch with one hand while the other hand rapidly removes the berries, working from the base upwards. Picking costs between 1 and 2 cents per quart—usually 1½ cents. English Gooseberries should be marketed either in quart boxes or in 5-pound Climax baskets.

924. Crown Bob, an English Gooseberry (× ¾).

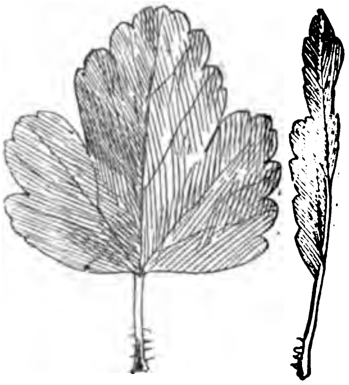
925. Industry, one of the English Gooseberries. Nearly natural size.

American varieties are nearly always picked green, and are usually called for in considerable quantities for stewing, jam making or for canning. These are shipped in 10- and 20-pound baskets. Beach, in Bull. 114, N. Y. Exp. Sta., gives the following reasons for marketing Gooseberries in the green condition: "(1) The hard, green fruit is not as easily injured in picking and packing as the pulpy ripe fruit, and it will stand transportation better. (2) The fruit that is allowed to ripen on the bushes is exposed longer to attacks of sunscald and mildew, and should long-continued rains follow a period of drought, the ripening fruit is liable to crack and spoil. (3) The ripening of fruit is an exhaustive process, from which the tree is partly relieved when the fruit is marketed green. (4) The proceeds from the green fruit usually compare favorably with the proceeds from the ripe fruit, although the large English varieties sometimes bring the highest prices of the season."

Gooseberries are very palatable if canned just before reaching maturity. Sugar should be used in the proportion of one-third to one-half pound to each quart of berries. When treated in this way, Gooseberry pie may be enjoyed at any time during winter. Gooseberry jam is indulged in to a considerable extent by residents of Iowa, Nebraska, Minnesota and Dakota. Wild berries are gathered and largely used for the purpose, their aromatic acidity giving a spiciness to the finished product which is notably wanting in that made from cultivated types.



926. Ribes oxyacanthoides in bloom (× ⅜).



927. Leaves of Ribes oxyacanthoides. Natural size.

Types and varieties.—Practically, there are two types of Gooseberries in cultivation.

1. The European (*Ribes Grossularia*, Figs. 922, 923), characterized by stocky, upright growth, light-colored spines, thick, glossy lvs. and large, variously colored fr. The plants are less hardy than our natives or their hybrids, are affected by our hot summer suns, and are very susceptible to fungous troubles, prominent among which is mildew. The New York Experiment Station recommends the following varieties: Crown Bob (Fig. 924); red, large, round, of good quality. Industry (Fig. 925), Lancashire Lad; fr. dark red, nearly round; plant prolific, healthy. Prince Harry; one of the largest, green, good quality.

2. Americans, and hybrids between European and American species, usually classed with Americans (Figs. 926, 927, 928): lvs. thinner than in *R. Grossularia;* leaf-stalks hairy, spines borne singly, fr. small, reddish green, shading off to purple. Pale Red may be considered a good type of the species. Varieties: Champion

928. An American Gooseberry (X ½)—Ribes oxyacanthoides.

partakes largely of European characteristics. Downing is the most widely planted of all Gooseberries in America (Fig. 929); fruit medium size, oval, green; plant upright, vigorous, healthy, productive. Houghton, an old favorite; fr. small, round, dark red, good quality. Pearl; almost identical with Downing, of which it is a seedling. Josselyn; fr. large, red, oval; plant vigorous and prolific. Another promising native type is *R. Cynosbati*, represented by the Mathews, of Iowa origin.

Propagation.—This is effected in three principal ways. (1) Cuttings: The Gooseberry does not "strike" very readily from cuttings. Native varieties root more freely than English types. The cuttings may be taken in the fall, as soon as the wood is ripened. They should be 7 to 9 in. long. They may be set in the ground at once, or tied in bundles and buried in the ground, or stored in a cold cellar over winter. The cellar must be cold—almost down to freezing point. Fall-set cuttings should be planted obliquely, so that the heaving of the ground will not throw them out. Set cuttings in nursery row 3 feet apart and give clean culture. (2) Layers: Propagation by layering is the common nursery practice. For this purpose, plants 5 or 6 years old are used. They should be vigorous and healthy. They should be cut back severely in the autumn or early spring. This encourages a dense, bushy growth. The layering is done by plowing a furrow against the row on each side and forcing the branches down by throwing soil directly on top of the bushes. In moist regions a comparatively small amount of covering is necessary. In dryish regions 5 or 6 inches of soil is necessary. In the fall the soil is removed and the rooted branches separated from the parent bush, leaving buds for the production of shoots the following season; or, the entire plant may be taken up and divided. (3) Root-cuttings: Native Gooseberries may also be propagated by cuttings of the roots. The plants are taken up in the fall with all roots possible. The latter are cut into 2- or 3-inch lengths and packed in boxes of earth, which are stored in a cold cellar. In spring the pieces of roots are planted in nursery rows, covered with 2 inches of soil. English varieties are not readily propagated by this method. When single-stem plants are desired, they should be grown from cuttings. In order to discourage sprouting tendencies the buds above the roots should be removed—disbudded. Layer plants are best for producing the bush form of plant used almost exclusively in America.

929. Downing Gooseberry.

Diseases.—The Gooseberry, as a rule, is affected seriously by only two plant parasites, mildew and leaf-spot. The former attacks the English varieties, while the latter is the chief fungous enemy of American varieties.

Mildew (*Sphærotheca Mors-Uvæ*): This is the bugbear of English varieties in America. It has done more to discourage the cultivation of this type than anything else. This fungus attacks shoots, foliage and fruit. It covers the affected part with a gray, frost-like coating. This turns to a dirty brown later on. It is a surface-growing parasite, and the web-like covering may be peeled from the fruit in its early stages. The ends of the shoots and younger leaves are attacked first, causing the bush to take on a stunted appearance. Remedies for mildew: (1) Sanitary: circulation of air secured by a favorable site, good drainage and proper training. (2) Fungicides: (*a*) Potassium sulphide, liver of sulphur 1 oz. to 2 gals. water. Spray 4 or 5 times, at intervals of 6 or 8 days, beginning with the unfolding of the leaves. (*b*) Bordeaux mixture may be used with good results for the first two applications. It stains the fruit when applied after the fruit is half-grown. (*c*) Dilute copper sulphate, 1 oz. to 15 gals. water, may be used throughout the season.

Leaf-spot (*Septoria Ribis*): This disease attacks the leaves only. It produces numerous small brown, irregularly shaped spots or patches on the lvs. This spotting causes a premature dropping of the lvs., often before the fruit is fully developed. Remedy: Spray early in the season, and again after harvesting the fruit, with Bordeaux mixture.

Injurious Insects.—(1) The imported Currant worm: The larva of a saw-fly attacks the foliage soon after fruit sets. The attack is first made on the lower leaves. From this point the worms work upward on the bush, stripping the leaves in their line of march. The worms are exceedingly voracious, and will defoliate a bush in 2 or 3 days. The mature insect is a saw-fly, which deposits its eggs on the under side of the leaf. Usually two broods occur during the season. Treatment: Spray with arsenical poison early. Bordeaux mixture and Paris green may be used in combination for the early spray. For the later sprays, fresh powdered hellebore, at the rate of 1 lb. to 50 gals. of water, is effective. The grower should not wait for the insect to make its appearance, but should ward off danger as soon as the leaves appear by spraying with Bordeaux mixture and Paris green, which will adhere to the foliage and be on the spot when needed. Other injurious insects are the Gooseberry fruit worm (*Epochra Canadensis*), which burrows in the green fruit, causing it to drop. Remedy: Destroy infested berries.

2. Currant borer (*Psenocerus supernotatus*): The larva of a moth. Eggs are laid near the tip of the cane, down the center of which the larva tunnels. Infested canes are readily detected. They should be cut out and burned. San José scale and four-lined leaf-bug are sometimes injurious. When a plantation is infested by the former it should be thoroughly treated with whale oil soap mixture in winter, diluted kerosene on sunshiny days in spring, or, in bad cases of infestation, it will probably be wisest to root up and destroy the bushes. Kerosene emulsion is used against the four-lined bug with success.

John Craig.

GOOSEBERRY, BARBADOES. See *Pereskia.*

GOOSEFOOT. Vernacular for *Chenopodium.*

GORDÒNIA (after James Gordon, an English nurseryman; died 1780). *Ternstrœmiàceæ.* Ornamental trees and shrubs with alternate, simple, rather large, deciduous or persistent lvs., axillary, showy white fls. and a woody capsule. Only *G. pubescens* is hardy north to Mass., while the others are cultivated only in subtropical regions. They all have very handsome shining foliage, and produce their large white fls. even on rather small plants. They grow best in a somewhat moist, peaty or sandy soil. Prop. by seeds, layers or cuttings from half-ripened wood under glass. About 15 species in the S. Atlantic states and subtrop. and trop. Asia. Fls. solitary and axillary toward the end of the branches; sepals and petals 5, rarely more; stamens numerous: capsule 5-celled, dehiscent with 2 or many usually winged seeds in each cell.

P. J. Berckmans writes that a large tree in the Bartram garden, near Philadelphia, was long supposed to be the only living specimen of *G. pubescens*. All other specimens in cultivation are believed to have been propagated from the Bartram tree, which has lately died. All efforts since 1790 to rediscover this tree in the South have failed.

A. *Foliage deciduous.*

pubéscens, L'Hérit. (*G. Altamáha*, Sarg.). Shrub or tree, to 30 ft.: lvs. obovate-oblong, narrowed into a short petiole, sparingly serrate, bright green and shining above, glabrous, turning scarlet in fall, 5–6 in. long: fls. short-pedicelled, pure white, about 3 in. across; petals roundish obovate, with crenulate margin, concave: capsule globular. Sept., Oct. Georgia, but not found again since 1790. S.S. 1:22. G.W.F. 47. Mn. 6:201. Gng. 7:167. M.D.G. 1899:25.—One of the few trees that flower in autumn.

AA. *Foliage evergreen.*

Lasiánthus, Ellis. LOBLOLLY BAY. Tree, to 60 ft., usually shrubby in cult.: lvs. obovate-lanceolate, narrowed into a short petiole, crenately dentate, dark green and shining above, 4–6 in. long: fls. long-pedicelled, white, 2–2½ in. across; petals oblong-obovate; stamens short: capsule ovate. July, Aug. Va. to Fla. and Miss. S.S. 1:21. B.M. 668.

anómala, Spreng. Large shrub: lvs. oblanceolate, narrowed into a very short petiole, entire or serrate, dark green above, 3–6 in. long: fls. almost sessile, creamy white, 2–3 in. across; petals roundish obovate. Nov. S. China. B.M. 4019 (as *Polyspora axillaris*). B.M. 2047 and B.R. 4:349 (as *Camellia axillaris*).

G. Javánica, Rolliss. See Schima Noronhæ.

ALFRED REHDER.

GORSE. *Ulex Europæus.*

GOSSÝPIUM (name used by Pliny, probably from the Arabic). *Malvàceæ.* COTTON (which see). Probably not more than a dozen original species, although more than 100 have been described. The species which have produced the cultivated Cotton are now much confused. Two or three species are in the trade for ornamental purposes: **G. Davidsonii**, Kellogg, from Lower California, a woody plant with handsome yellow but rather small fls. (1 in. long), and small cordate, mostly entire lvs. **G. Stúrtii**, F. Muell. A shrub of several feet, more or less marked with black dots: lvs. broadly ovate, entire: fls. large, purple, with a dark center.

L. H. B.

GOUÀNIA (Antoine Gouan, 1733–1821, professor of botany at Montpelier, France). *Rhamnàceæ.* This genus includes the "Chawstick" of Jamaica, a rapid-growing, shrubby vine, with pretty heart-shaped lvs., grown sometimes for ornament in the extreme South. It is suitable for screening unsightly objects. The stems are chewed in the West Indies. Tooth brushes are made from the frayed ends and tooth-powder from the pulverized wood. The genus has about 30 species of shrubs, sometimes tall climbers, tendril-bearing: branches long and slender: lvs. alternated, petiolate, penninerved, entire or dentate: fls. in clusters, arranged along axillary and terminal, elongated peduncles; disk 5-lobed; style 3-fid: capsule with 3 indehiscent berries.

Domingénsis, Linn. Lvs. usually 1½–2 in. long, elliptical, glabrate, with blunt, distant serratures; veins tapering towards the margin: capsule winged, emarginate. West Indies.

GOUMI. See *Elæagnus.*

GOURD. In England, a generic name for species of Cucurbita (which see). In America the term is used to designate those cucurbitous fruits which are hard-shelled, and are used for ornament or for the making of domestic utensils. The Gourd of history is probably Lagenaria. In the northern United States, the small, hard-shelled forms of *Cucurbita Pepo* (var. *ovifera*) are commonly understood when the word Gourd is used. The Gourds in the Amer. trade are referable to their species as follows:

Anaconda, *Lagenaria vulgaris.*
Apple-shaped, *Cucurbita Pepo.*
Bicolor, *Cucurbita Pepo.*
Bonnet, *Luffa.*
Bottle-shaped, *Lagenaria vulgaris.*
Calabash, *Lagenaria vulgaris.*
Coloquinte, *Cucurbita Pepo.*
Dipper, *Lagenaria vulgaris.*
Dipsaceous, *Cucumis dipsaceus.*
Dish-cloth, *Luffa.*
Egg, Egg-shape, *Cucurbita Pepo.*
Gooseberry, *Cucumis Anguria.*
Hedgehog, *Cucumis dipsaceus.*
Hercules' Club, *Lagenaria vulgaris.*
Maté Gourd, small form of *Lagenaria vulgaris.*
Mock Orange, *Cucurbita Pepo.*
Onion-shaped, *Cucurbita Pepo.*
Orange, *Cucurbita Pepo.*
Ostrich Egg, *Cucumis dipsaceus.*
Pear-shaped, *Cucurbita Pepo* (Fig. 597).
Powder Horn, *Lagenaria vulgaris.*
Rag, *Luffa.*
Serpent or Snake (not Snake Cucumber, which is a Cucumis), *Lagenaria vulgaris* and *Trichosanthes.*
Sponge, *Luffa.*
Spoon, *Lagenaria vulgaris.*
Sugar Trough, *Lagenaria vulgaris.*
Tashkent, *Cucurbita Pepo.*
Turk's Turban, *Cucurbita Pepo.*
Vegetable Sponge, *Luffa.*
Wax Gourd, *Benincasa cerifera.*

L. H. B.

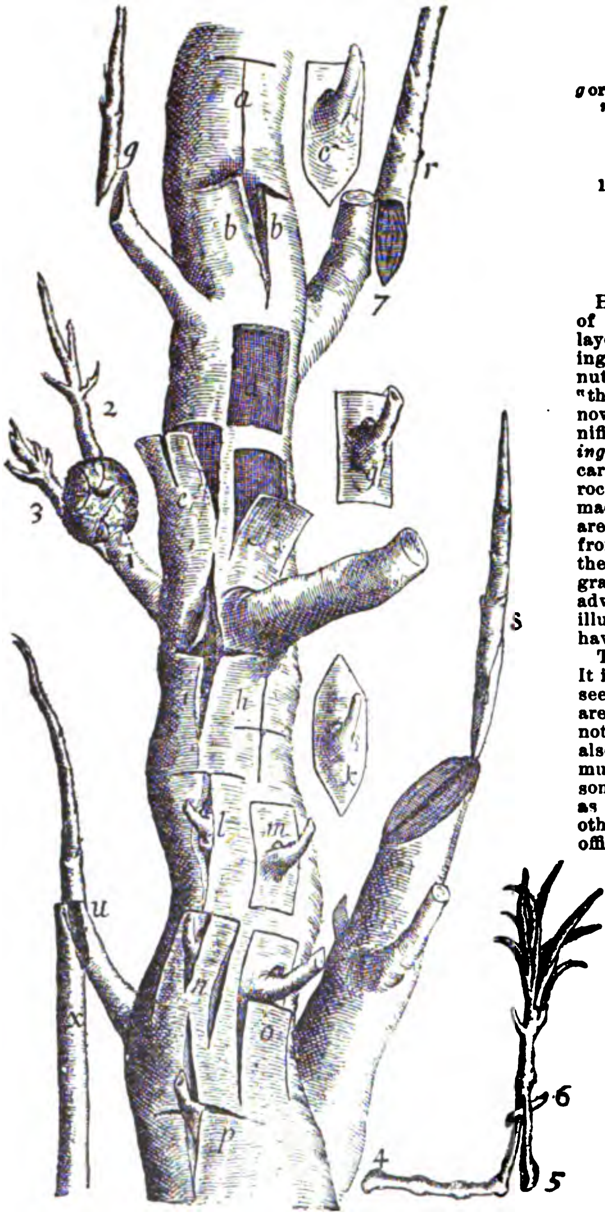
GRAFTAGE comprises the process and operation of inserting a part of one plant into another, with the intention that the part shall grow on the foster root, together with all the questions which arise in relation to the practice. It is a comprehensive or generic term, whereas *grafting* is a specific term designating merely the operation. The term *Graftage* (analogue of the French *greffage*) was proposed by the present writer in 1887.

Grafting is one of the oldest of the arts of plant-craft. It is probable that the real art of grafting has held more or less as a professional or class secret in the ancient world, for the writers seem to have only the vaguest notion of its possibilities and limitations. Vergil writes (Preston's translation):

> But thou shalt lend
> Grafts of rude arbute unto the walnut tree,
> Shalt bid the unfruitful plane sound apples bear,
> Chestnuts the beech, the ash blow white with the pear,
> And, under the elm, the sow on acorns fare.

It seems to have been a popular misconception that any kind of plant will grow on any other. Pliny asserts that the art of grafting was taught to man by nature. Birds swallow seeds, and these seeds, falling in "some cleft in the bark of a tree," germinate and make plants. "Hence it is that we see the cherry growing upon the willow, the plane upon the laurel, the laurel upon the cherry, and fruits of various tints and hues all springing from the same tree at once." This, of course, is not grafting at all, but the implanting of seeds in earth-filled chinks and cracks, in which the plants find a congenial foothold and soil. But the ancients have left us abundant testimony that genuine grafting was employed with success. Pliny describes a cleft-graft. He gives several precautions: the stock must be "that of a tree suitable for the purpose," and the graft must be "taken from one that is proper for grafting; the incision or cleft must not be made in a knot; the graft must be from a tree "that is a good bearer, and from a young shoot;" the graft must not be sharpened or pointed "while the wind is blowing;" "a graft should not be used that is too full of sap, no, by Hercules! no more than one that is dry and parched;" "it is a point most religiously observed, to insert the graft during the moon's increase."

The accompanying cut (Fig. 930) reproduced exact size from Robert Sharrock's "History of the Propagation and Improvement of Vegetables," 1672, shows various kinds of grafting in vogue over two centuries ago. Following is the literal explanation of the plate :



930. Sharrock's illustration of the modes of Grafting. 1672.

The Exemplification of the Operations by the Figure.

a. Denotes the ordinary cutting of the bark for inoculation.
b b. The sides of the bark lifted up for the putting in of the shield.
c. The shield taken off with the bud, which lies under the stalk of the leaf cut off.
l n. The shield put into the stock to be bound up.
d. The bark cut out in an oblong square, according to another usual way of inoculation.
g. The shield cut out for the fitting the disbarked square.
m. The same shield put into the stock.
f. A variation of the forementioned way, by cutting off the upper part of the oblique square, and binding the lower part down upon the shield.
o. The shield so put in to be bound up.
e. Another variation by slitting the bark, that the bud and leaf may stand forth at *e*, and the bark slit be bound down upon the shield.
h. A cross cut for inoculation.
i. The same cross cut lifted up, in this figure somewhat too big.
k. The shield cut off to be put therein.
p. The shield put in.
g or *q*. The cut of cyon or stock for whip-grafting.
r 7. The cut of cyon and stock for shoulder-grafting.
s. The cut of the cyons and slit of the stock for grafting in the cleft.
x. The stock set for ablactation or approach.
u. The cyon of the branch for the same operation.
1 2. The branch that is to be taken off by circumposition.
3. The branch that bears up the mold to the disbarked place.
4. The branch of a carnation to be laid.
5. The joynt where the slit begins.
6. The next joynt where the slit is propped open, with a piece of a carnation leaf put in.

Herein are seen the germs of all the grafting practices of the present day, together with some practices of layering. Sharrock treated the whole subject of grafting under the head of "Insitions," and here he minutely describes the cleft-graft, and speaks of it as "the common way of grafting." The practice which we now know as inarching or grafting by approach, he significantly calls "Ablactation" (that is, *suckling* or *weaning*). Now that so much is said about the proper and careful selection of cions, it is interesting to read Sharrock's advice on this subject : "Good bearing trees are made from Cyons of the like fruitfulness. * * Cyons are best chosen from the fairest, strongest shuits, not from under shoots or suckers, which will be long ere they bear fruit, which is contrary to the intention of grafting." But we have seen that Pliny gave similar advice before the Christian era,—which is only another illustration of the fact that most of our current notions have their roots deep in the past.

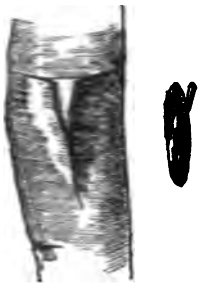
The chief office of grafting is to perpetuate a variety. It is employed in those cases in which plants do not bear seeds, or in which the seeds do not come true or are difficult to germinate, or when the plants do not propagate well by cuttings or layers. It is also employed to increase the ease and speed of multiplying plants. A third office is to produce some radical change in the nature of the cion, as rendering it more dwarf, more fruitful, or otherwise changing its habit. A fourth general office of grafting is to adapt plants to adverse soils or climates. An example is the very general use of the peach root in the southern states upon which to work the plum, as the peach thrives better than the plum in sandy soils. The practice in Russia of working the apple on roots of the Siberian crab is an example of an effort to make a plant better able to withstand a very severe climate.

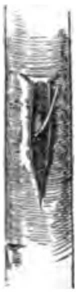
In common practice, the effect of the stock on the cion is rather more a mechanical or physical one than physiological or chemical. The influences are very largely those which are associated with greater or less growth. As a rule, each part of the combined plant—the stock and cion—maintains its individuality. There are certain cases, however, in which the cion seems to partake of the nature of the stock ; and others in which the stock partakes of the nature of the cion. There are recorded instances of a distinct change in the flavor of fruit when the cion is put upon stock which bears fruit of very different character. There are some varieties of apples and pears which, when worked upon a seedling root, will tend to change the habit of growth of that root. Examples are Northern Spy and Whitney apples, which, when grafted on a root of unknown parentage, tend to make that root grow very

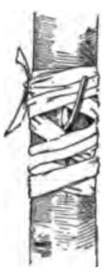
931. Stick of buds. (X ⅓.)

deep in the soil. All these instances seem to be special cases, or exceptions to the general rule that each part maintains its individuality. Reasons for this change of nature in these cases have not been determined, and in most cases such results are not to be predicted. The most marked effect of stock on the cion is a dwarfing influence. Dwarfing may be expected whenever the stock is of a smaller stature than the cion. The most familiar example is the dwarf pear, made by working the pear on quince stock. Supplying a plant with a slow-growing root is only the beginning of the making of a dwarf. The plant must be kept dwarf by subsequent pruning and other care. It is significant that there is comparatively little demand for large-growing forms of woody plants, whereas there is a great demand for dwarf forms.

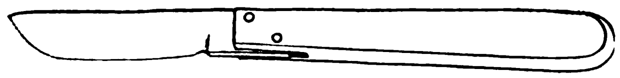
Extended experiments on plants which are not commonly grafted have thrown considerable light on the possible mutual influences of cion and stock. The researches of Daniel (whose latest contribution comprises nearly all of vol. 8 of Ann. Sci. Nat. Ser. 8, Botany, 1898) show that the stock may have a specific influence on the cion, and that the resulting characters may be hereditary in seedlings. These experiments, as also those of Vöchting, have thrown much light on the physiology of grafting and the variation induced by it, but they will not modify the practices of horticulturists nor greatly change our ideas respecting the results to be obtained from accustomed operations. Experience has long since determined what general and practical results are to be expected from grafting.


932. Shield-budding (× ½).

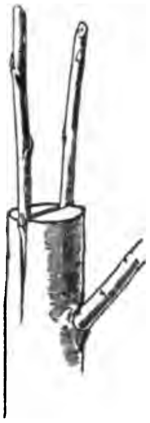

933. The bud set in the matrix (× ½).

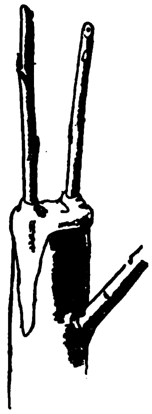

934. The bud tied.

The limits within which grafting can succeed are to be determined only by experiment. These limits are often within the species, and usually within the genus, but there are instances in which plants of distinct genera intergraft with success, as in some of the cacti. But generic and graftage limits are not comparable: genera are only arbitrary divisions proposed for purposes of classification, and intergrafting, like intercrossing, has no necessary relation to these conceptions. In general, the closer the affinity of cion and stock, the better the union. When stock of the same species cannot be secured, it is allowable to choose another species. Thus it has been impossible to secure Japanese plum stocks upon which to grow the varieties of Japanese plums, and peach, Marianna, myrobalan and domestica plum stocks have been used. In some cases another species grows more readily from seed, is cheaper, is less liable to fungous injury in the nursery, or has some other practical advantage. Thus, most domestica plums (*Prunus domestica*) in the North are worked on the myrobalan (*P. cerasifera*); most sweet and sour cherries (*Prunus Avium* and *P. Cerasus*) are worked on the Mahaleb (*P. Mahaleb*); many kinds of roses are worked on manetti and *Rosa multiflora* stocks.


935. Budding knife (× ½).

From time to time there arises an agitation against grafting, particularly in the Old World. Cases of poor unions and the difficulties of sprouting from the root or stock are cited as proofs that graftage is injurious and devitalizing. But these are instances of poor graftage. They show what should not be done. Properly done, on plants of proper affinity, graftage is not devitalizing. It is essential to modern horticulture. There are disadvantages, to be sure, but the advantages overbalance. There are disadvantages in wearing boots. There is no use in arguing against things which are indispensable.


936. Cleft-grafting.


937. The cleft-graft waxed.

The ways or fashions of grafting are legion. There are as many ways as there are ways of whittling. The operator may fashion the union of the stock and the cion to suit himself, if only he apply cambium to cambium, make a close joint, and properly protect the work. Thus, Thouin in his "Monographie des Greffes," 1821, describes 119 kinds of grafting. All kinds of grafting may be classified into three groups:

1. Bud-grafting or budding. In the old days called inoculation.
2. Cion-grafting, or what is now thought of as grafting proper.
3. Grafting by approach, sometimes called inarching.

A word may be needed about the terminology of graftage. As already explained, *grafting* is merely the operation of inserting a part of one plant into another; but it is ordinarily restricted to grafting by means of short twigs or cions, and *budding* is used to designate the insertion of single buds which are severed from the branch on which they grew. *Stock* is the plant or part on which the grafting is done. *Cion* is the part inserted into the stock, although it is usually restricted to cuttings of twigs, and does not include detached buds. In many writings the word is spelled *scion*, but the other is shorter and etymologically more correct. When the writer found it necessary to use the word in print, he chose the shorter form, although it is not commended by the dictionaries. It has been said that *cion* is an anatomical term. It may be; but it was originally a horticultural term. The early horticultural writings used *cion* and *cyon*. *Scion* is later, and has nothing to commend it except usage; but the usage is not uniform. The word *graft* is sometimes used in the sense of *cion*, but it would better be used for the completed thing,—the new plant or part made by the joining of cion and stock.

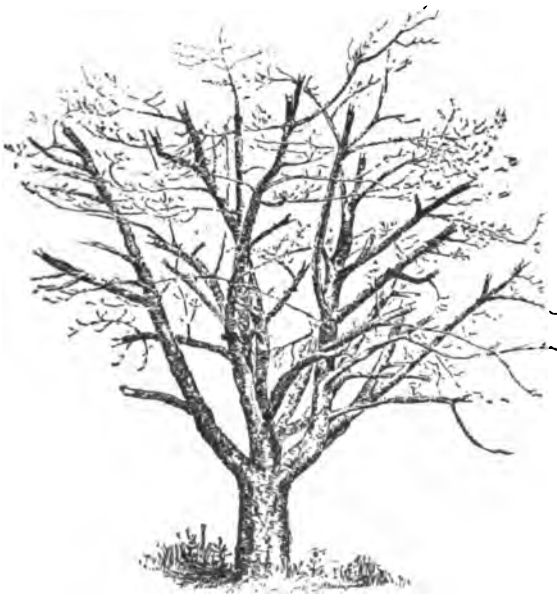
938. Cleft graft cion.

Budding.—The operation of budding consists of inserting a single detached bud underneath the bark of the stock. It is employed only in stocks of small diameter, and preferably in those not more than one year old. The operation may be performed whenever the bark will peel and whenever mature buds may be obtained. The bark will peel in early spring and again in late summer or early fall, and the operation of budding in the open ground is therefore performed at those times. In the spring the buds are secured from twigs of the previous season's growth. At the second budding season, in late summer or early fall, the buds are secured from growing twigs of the season. At that time of the year the buds will be sufficiently developed to be easily recognized and handled. Budding is much employed in nurseries. Peaches, cherries, plums, and most stone fruits, are habitually budded rather than cion-grafted. In the East apples and pears are usually budded in the nursery; but in the West apples at least are usually root-grafted. It is practicable to insert buds in the tops of young trees, rather than cions, for the purpose of changing the tree into a different variety. Sometimes the buds are inserted in limbs which are two and three years old; but it is usually preferable, if the tree is of some age, to cut back the tree somewhat heavily the previous season or the previous spring, in order to get a growth of suckers into which the buds may be set. Third-rate stocks are sometimes set in nursery rows and budded the following July in western nurseries.

The cutting from which the buds are taken is known to budders as *a stick* (Fig. 931). In early spring budding, this stick is the last year's growth of the variety which it is desired to propagate. Later in the season the stick is the twig which is grown during that season. Not all the buds on the stick are strong enough or good enough for budding. The budder will usually discard the weak ones at the top and at the bottom, unless he is very much pressed for buds, as may be the case with new or rare varieties. If the stick is taken late in the season the leaves will be on; but these are quickly cut off to prevent too much evaporation from the cutting. About one-fourth of an inch of the leaf-stalk is left to serve as a handle to the bud.

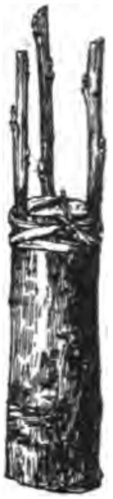
The ordinary operation of budding is that which is shown in the illustrations. It is known as shield-budding, from the shape of the removed bud. With a thin-bladed, sharp knife, the operator slices off the bud by placing his thumb beneath the bud and making a deft and quick stroke of the blade. Just under the bud he cuts a little into the wood. Some budders afterward remove this bit of wood; but this is not essential. If this wood is somewhat hard and dry, or if it carries some pith with it, it may serve to dry out the bud or to prevent intimate contact with the cambium of the stock. In ordinary operations this truncheon of wood is not removed. Most budders cut all the buds on a stick before they insert any of them; but they are allowed to hang to the stick by their upper or lower ends, being snipped off by the knife as fast as they are needed (Fig. 931).

The stock is first prepared by removing all the leaves and twigs from the area which is to be budded. In the case of nursery stock, it is customary for a boy to strip the lower leaves of the stock a day or so in advance of the budding. If the stripping is done three or four days or a week before the budding, it will sometimes cause the bark to set and, therefore, interfere with the operation. Nursery trees are usually budded as near the ground as the operator can work—not more than 2 or 3 inches above the surface. In most cases, the budder prefers to set the bud on the north side of the stock in order that it may be shaded from the hot sun.



939. Cleft-grafting of an old tree.

A T-shaped incision, just through the bark, is made on the stock (Fig. 932). The crosswise incision is usually made first. As the operator takes his knife from the last incision which he makes, he gives it a deft turn to right and left and loosens the flaps of the bark, so that the bud can easily be inserted. The bud is now taken from the stick and shoved into the matrix underneath the bark until it is entirely within the cleft (Fig. 933). A boy follows and ties the bud, making 4 or 5 deft turns and holding the strand by covering the lower end underneath one of the turns (Fig. 934). No wax or other covering is used. Any soft strand may be used for this purpose. It was the old custom to use basswood bark, which was taken in the spring from the inner layers of the bark of the basswood tree. This material was then macerated in water and afterwards pounded to make it soft. Yarn is also used. At the present time raffia is universally employed. This is the stripping of an oriental palm, and it can be bought in the market at about 20 cents per pound, and at that price is cheaper than home-made materials; it is also better. It is customary to lay it on the ground or in a damp place over night in order to soften it and to allow the operator to flatten out the strands. This raffia is cut in the length to suit before the tying is begun, and the bunch of strands is then held underneath the belt or carried in a box. For budding, the operator prefers a small, thin-bladed knife, with a rounded or thumb-shaped cutting surface (Fig. 935).



940. Bark-grafting.

When budding is performed late in the season, the bud does not throw out a shoot until the following spring. It merely grows fast or "sticks" to the stock. Two or three weeks after the setting of the bud, the bandage is cut so that it will not restrict the swelling of the stock. If the stock grows very rapidly, it may be necessary to cut the bandage before that time. Nothing more is done with the tree until the following spring, at which time the whole tree is cut off about one inch above the bud. This one bud now throws out shoots and makes a very heavy growth, being impelled by the strong root. During this first season of growth a peach tree will attain the height of four to six feet, and be ready for market in the fall. If the bud is set early in the spring it will throw out a shoot the same season; but ordinarily it would not make the growth in one season that the bud does in the other case. Spring budding in the open air is rarely employed in nursery practice. It is sometimes used in the top-budding of established plants. In all budding practices, it is important to keep down the suckers from the stock.

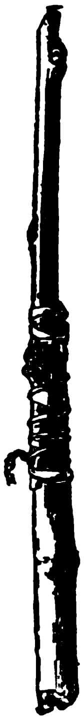
In the South a peach tree may be large enough in June, if the seeds are planted in February or March, to be budded. The bud will grow the same year, and by fall will make a salable tree. This operation of budding in early summer on stocks which grow that year is known as June-budding. As a rule, June-budded trees are smaller than fall-budded trees; but they can be obtained one year sooner.

There are many other kinds of budding. Some of these will be found in American writings. None of these other styles of budding, however, is of commercial importance in this country.

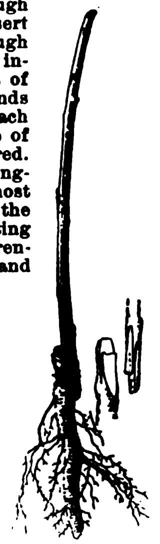
GRAFTING proper is the operation of inserting a twig or a woody cion into a stock. The kinds of grafting are very many. Few are described here. They may be classified in respect to the place or position of the cion on the stock: root-grafting, or the insertion of the cion in the root of the stock; crown-grafting, or the insertion of the cion at the crown (surface of the ground); stem-grafting, or the insertion of the cion in any part of the main stem or trunk; top-grafting, or the insertion of the cion in the top or branches of the plant. Grafting may again be classified in respect to the maturity of the cion: dormant wood grafting; and softwood or herbaceous grafting, in which the cion is taken from green or growing wood.

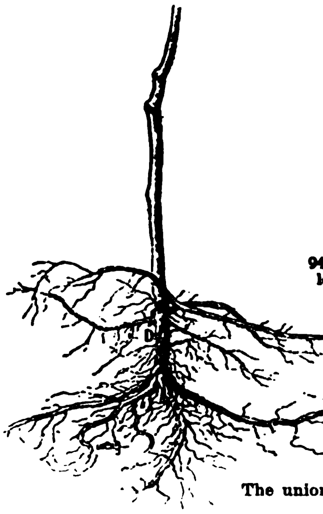
It is customary to classify grafting in respect to the way in which the union is made. There are three general types in common use in this country: cleft-grafting, whip-grafting, veneer-grafting.

Cleft-grafting consists in splitting the stock and inserting a wedge-shape cion into the cleft. It is employed only in rather large stocks, preferably in those which are an inch or more in diameter. The stock is cut off, and it is split with a knife made for the purpose. The cleft is then held open by a wedge and the cions are inserted in the side of the cleft in such position that the cambiums of the stock and cion are in contact (Fig. 936). The whole surface is then securely waxed in order to prevent evaporation and to protect the wounds from the sun (Fig. 937). Cleft-grafting is performed in early spring. The cions are taken some time previously from the last year's shoots. They are stored in the cellar or other cool place in order that they may be perfectly dormant. It is customary to cut them of three buds' length; but if the shoot is very long-jointed and if the variety is new or rare, and the wood therefore scarce, they may be made of one or two buds. The wedge-shaped part should be somewhat thicker on the outside in order that it may be clasped tightly in the cleft (Fig. 938). It is customary to have one bud near the top of the wedge. Although this bud is covered with wax, it is the most likely to grow, since it is nearest the source of food supply and is less injured by external conditions. It pushes through the wax. It is customary to insert two cions in all stocks, even though only one branch is desired. By inserting two cions, the chances of success are doubled, and the wounds heal better if a twig grows on each side. After a year or two, one of the cions may be cut off if desired.


941. Whip-graft.

There are many kinds of grafting-wax, but the one which is most serviceable for applying with the hands in the open air is made by melting together one pound (by weight) of rendered tallow, two parts of beeswax and four parts of resin. The melted liquid is poured into a pail or tub of water, when it immediately hardens. It is then pulled until it is light-colored and develops a grain. It is then put away for future use, and will keep indefinitely. When used, the warmth of the hands will cause it to soften. The hands should be greased to prevent it from sticking.

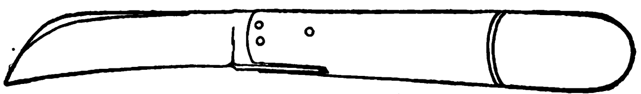

942. Root-graft with long cion (× ⅛).



The union is at D.

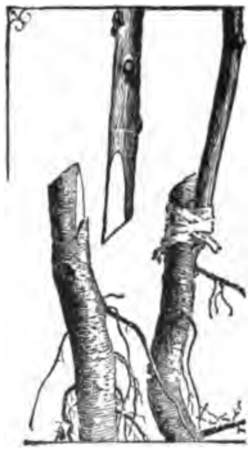
943. Tree grown from a long-cion root-graft.

Cleft-grafting is the method usually employed in the top-grafting of fruit trees, as apples, pears, plums and cherries. Old peach trees are rarely changed over to a new variety. If they are, budding is employed, as already suggested: the limbs are headed back so that new wood is secured in which the buds may be set. It is important, in all top-working of fruit trees, to keep down the suckers which spring up around the cion, and which sometimes completely choke it. In changing over the top of a fruit tree, all the leading branches should be grafted (Fig. 939). It is well to stand at some distance from the tree and make a mental picture of how the tree will look when the new top is secured: the grafts should be set in approximately a radius from the center of the tree. It is rare that the stock should be larger than two inches in diameter where the cions are set. On some of the main branches it will be necessary to graft side branches lower down in order to fill the top and to afford footholds to pickers and pruners. It will require from three to four years to change over the tree to a new variety. Each year a little more of the original top is removed, and the cions take more and more of the space.


944. Grafting knife (× ½).

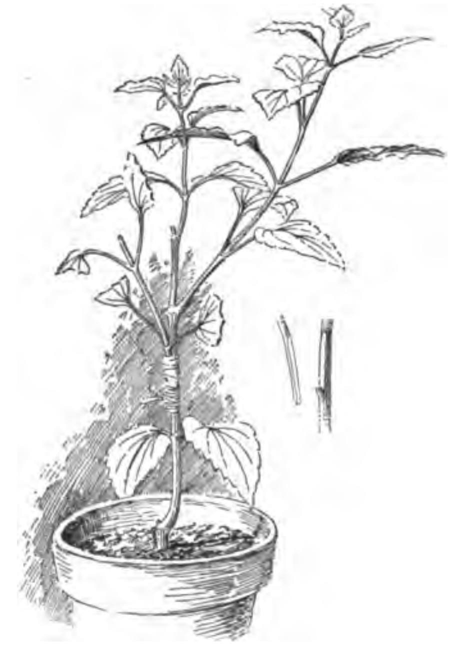
Bark-grafting (Fig. 940) is a most excellent method of grafting fairly large limbs, since it does not injure the stock so much as the cleft-graft. The cions are cut thin and inserted between the bark and wood. The bark is securely bound to hold it tight, and the entire surface is waxed, as in cleft-grafting. This method is called crown-grafting by the French and English.

Whip-grafting is employed in the nursery and on very small stocks. It is not used in top-grafting except now and then on small limbs. The pictures sufficiently illustrate how the work is done. The cion and stock should be of approximately equal size. Each is cut off in a slanting direction, and a split or tongue is made near the middle. The same shape is given to cion and stock (Figs. 941, 942). The object of the tongue is to hold the parts together securely; it also presents more contact. The cion is then bound to the stock, preferably by means of waxed cord. If the graft is above ground, the wounds should be thoroughly waxed over the string. If the graft is below ground, the tie will be all that is necessary: the moist earth packed around the wound will prevent evaporation and protect it.


945. Veneer-grafting.

The chief use of the whip-graft is in root-grafting, which is employed chiefly on apples and mostly at the West. In the East, other things being equal, budded apple trees are preferable to root-grafted trees. In the West, however, it is necessary to have apple trees on roots of known hardiness. The seedling stocks are not of known hardiness, even though the seeds have come from the hardiest varieties. It is therefore customary to use cions 6 to 12 in. long, grafted onto pieces of roots 2¼–4 in. long (Fig. 942). The graft is set so deep that only the top bud of the cion projects above the surface. The piece of root acts as a nurse, and roots may start from the cion itself (Fig. 943). When the tree is transferred to the orchard, the original root may be cut off in case it is not very vigorous; although this is not done if the union seems to be good and the foster roots are strong. This root-grafting is done in winter (Dec. and Jan. preferred); the grafts are stored in clean sawdust, sand or moss in a cool cellar, and are set in nursery rows in the open early in the spring, after the manner of grape cuttings.

The waxed string, with which the whip-grafts are tied, may be made by dropping a ball of yarn into the melted grafting wax which is spoken of above. In five minutes the wax will have penetrated the ball, but the strand can readily be unwound. The best material for this purpose is No. 18 knitting cotton. This is strong enough to hold the work together, and yet weak enough so that it may be broken in the hands without cutting the fingers. It will ordinarily decay during the year, and thereby not interfere with the growth of the tree. If the grafting is done in a room at a living temperature, the waxed string should be soft enough to stick to the stock without being tied. Four or five turns are made around the union. Waxed Manila paper, cut in narrow strips, is also much used; also single strand cotton "chain" or warp-thread, either waxed or not waxed.

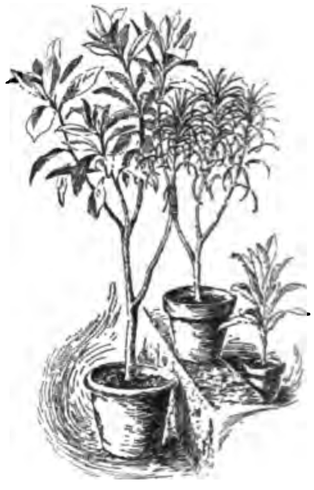


946. Veneer-grafting.

Any sharp knife with a handle large enough to be grasped readily is useful for whip-grafting. The blade should be thin, and the steel of best quality. The handle should also be strong. Fig. 944 shows a common form of grafting knife. Good shoe-knives may be used.

Veneer-grafting.—This style of grafting, which is considerably used under glass with fancy and ornamental plants, consists in simply champering the surfaces of cion and stock and applying the one to the other (Fig. 945). The cion is bound to the stock by raffia or other material. If the graft is in the open the wounds are thoroughly waxed; but in the house they may be covered merely with moss. This style of union is used with herbaceous plants, as well as on hard wood. Sometimes the stock is severed at the point of union, as in Fig. 945; but in other cases it is not severed nor headed back until the cion has taken hold (Fig. 946). In the latter case, the stock is not injured in case the graft does not grow.

Herbaceous grafting. — Pelargoniums, chrysanthemums and other soft-wooded greenhouse plants are sometimes grafted for the novelty of having more than one variety growing on the same root. Probably most herbaceous plants can be grafted readily, with the exception of the endogens, which do not lend themselves to the operation, although there are instances in which grafting has been made successful on them. In order to succeed with an herbaceous cion, it is necessary that the room be rather close and moist in order that evaporation may not be very rapid. One should endeavor to secure the general conditions which obtain in a good propagating house. The temperature should be kept rather below the normal for that species until union has taken place. It is usually best to cover the union with moss or some other material in order to protect the wound and to check evaporation. Best results are secured when the cion is firm in texture, as also in the case of herbaceous cuttings. The kind of graft is of less importance, although it is customary to use the veneer-graft cions, since there is less injury to the stock and the outer surfaces are easily applied to each other. The cion ordinarily consists of one or two joints, and if the leaves are large, they are cut in two, as in the making of softwood cuttings.

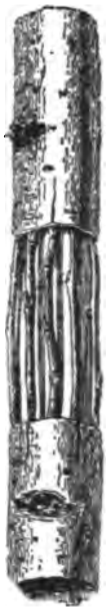


947. Inarching the branches of two plants.

Inarching.—In those cases in which union takes place with much difficulty, it is possible to effect the conjunction by allowing the cion to grow fast to the stock before the cion is severed from its own roots. The plant which it is desired to have grow on the stock is bent over to the stock, the surfaces of the two are exposed so that the cambiums may be pressed close together, and the two are then bound until union takes place. In some cases a tongue is made in both the cion and the stock, much as in whip-grafting, so that the surface of contact is greater and the parts are held together more securely. When the cion has become thoroughly established on the stock, the cion is severed from its own root and the top of the stock is cut off. This inarching or grafting by approach is also used in the greenhouse when it is desired to transfer the whole top or the whole branch of one plant to another. The illustration (Fig. 947) shows such a case. Inarching is seldom employed in this country in a commercial way.

Inarching is sometimes employed to unite two branches into one for the purpose of making a specimen fruit grow larger. If, for example, a twig of an apple tree is inarched into a limb just back of a fruit, the extra food supply may cause that fruit to grow larger, and a finer specimen may be obtained. This use of the graft is employed only for the purpose of securing extra fine specimens for exhibition or other purposes.

Bridge-grafting. — Wounds or girdles may be bridged by cions, as in Fig. 948. Trim the edges of the girdle to the fresh, firm tissue, insert cions which are whittled wedge-shape at each end, draw bandages around the trunk so as to hold the free edges of the bark and the ends of the cions, and pour melted wax over the work. This operation is performed in spring, with dormant cions. Prevent the buds from throwing out shoots.



948. Bridge-grafting.

If the cions are placed close together, they will soon unite along their sides and make a continuous covering of the wound.

Literature.—For further discussion of the whole subject of grafting, the reader is referred to current works on fruit-growing; also to the two American special books on the subject—Fuller's "Propagation of Plants" and Bailey's "Nursery-Book." In English work, "Baltet's "Budding and Grafting" is standard. It is an English version of "L'Art de Greffer." L. H. B.

GRAM, or CHICK PEA. *Cicer arietinum.*

GRAMMÁNGIS (Greek, *gramma;* perhaps referring to the markings of the fls.). *Orchidàceæ*, tribe *Vándeæ*. Species about 4, of Madagascar and Java. Pseudobulbs short and thick, with foliage-leaves only at their summit, hence not enclosed in the leaf-sheaths: fl.-clusters from the base, many-fld., pendulous: fls. not spurred; middle sepal strongly concave, lateral sepals somewhat sac-shaped at base, free, spreading; petals ascending, somewhat different in form and color; lip 3-lobed, with erect lateral lobes and recurved middle lobe; column slender, winged. Nearest Cymbidium, differing chiefly in having the foliage-leaves only at the end of the pseudobulb, and the rostellum crescent-shaped (in Cymbidium it is triangular). From Grammatophyllum (which see), Grammangis differs in the attachment of its pollen masses and in the position of its foliage-leaves. Best cultivated in baskets hung near the glass, where the light is most intense. The plants can also be grown successfully in pots placed near the glass, or fastened to blocks, but in the latter case they must be given more water.

Éllisii, Reichb. f. (*Grammatophýllum Éllisii*, Lindl.). Pseudobulbs 7–11 in. long, each bearing 5–6 lvs.: lvs. 1½–2 ft. long: sepals yellow, elegantly marked with dark transverse lines; petals and lip pale pink, the latter with a strong mid-nerve. Summer. Madagascar. B.M. 5179.

G. Húttoni, B. & H. (Cymbidium Húttoni, Hook. f.). Pseudobulbs of a single internode, 3–5 in. long, elongated, obovoid, green: lvs. in pairs, 6–8 in. long, 2–2½ in. wide, dark green, coriaceous: raceme about 10-fld., drooping: sepals obovate, recurved, light brown outside, streaked transversely inside with chocolate color; lip greenish, with chocolate stripes. June. Java. B.M. 5676. T. H. Kearney, Jr.

GRAMMÁNTHES (Greek, *letter-flower;* the petals of the full-colored varieties with a darker mark like a letter V, whence also the name of the synonymous genus *Vauanthes*). *Crassulàceæ*. This genus includes a small, half-hardy, annual, succulent plant, with thick, fleshy lvs. and yellow fls., which grows about 6 in. high and is used for edgings, baskets and pots. All the 9 specific names are now referred to one, *G. gentianoides*. Beside the type, 4 botanical varieties were recognized in Flora Capensis 2:331 (1861–2). Calyx bell-shaped, semi-5-fid.; corolla tube as long as the calyx; limb 5–6-lobed: carpels 5–6, many-ovuled, with awl-shaped styles: scales minute, and evanescent: follicles many-seeded.

gentianoides, DC. Glabrous, somewhat glaucous: branches forking: stems rigid, filiform: lvs. opposite, distant: fls. orange, yellow, or creamy white, and marked as above described. Cape. B.M. 4607 and 6401. F.S. 5:518. The type (var. **vèra**, Haw.) has lvs. ovate-oblong: limb of corolla ovate-oblong, a third longer than the stamens. Var. **chloræflora**, Haw., has lvs. oblong or linear: fls. a little larger; limb of corolla ovate-lanceolate, twice as long as the stamens. W. M.

GRAMMATOPHÝLLUM (Greek, *gramma*, a line or streak, and *phyllon*, leaf; probably referring to the parallel leaf-veins). *Orchidàceæ*, tribe *Vándeæ*. A small genus of perhaps 8 or 9 epiphytic species, of which about half are well-defined, inhabiting the islands from Madagascar to the Philippines and New Guinea. The genus includes some of the largest and showiest of cultivated orchids. Roots numerous: stems or pseudobulbs many-leaved: lvs. long, ribbon-shaped, thick, evergreen: racemes long-stalked, loosely many-fld., springing from near the base of the pseudobulb: fls. large, not obviously spurred; sepals and petals nearly equal, spreading; lip comparatively small, with margin entirely free, 3-lobed, with erect lateral lobes; column slender. Allied genera are Grammangis and Cymbidium, from both of which Grammatophyllum differs in having the pollen masses each borne upon an appendage of the stalk, while in the two related genera they are attached to a common stalk without special appendages.

The few species in cultivation are such infrequent bloomers that the flowering of a fine example is something of an event. They are propagated from pieces of the pseudobulbs. The plants are best grown in good-sized and well-drained pots filled with peat, and need considerable water while actively growing. They should be allowed to rest occasionally. Season of bloom and further cultural details with each species.

T. H. Kearney, Jr.

Cultivate Grammatophyllums in shallow perforated pans three-fourths filled with broken potsherds. The solid part of the potting material should be of fern fiber packed very tight and thin. Place near the strongest sunlight, under lightly shaded glass. Keep a temperature of 70° to 95° in the growing season. Give plenty of water while growing. They need a long season of rest, without water, in a shaded house, in a temperature of 50° to 55°. Wm. Mathews.

A. *Pseudobulbs very long, comparatively slender.*

speciòsum, Blume (*G. Sanderiànum*, Hort.). Letter Plant. Pseudobulbs 6–10 ft. long, slender, flexuous: lvs. 2-ranked, 1–2 ft. long: flower clusters open, sometimes 6 ft. long from the base of the stalk: fls. numerous, 6 in. in diam., clear yellow, spotted with deep red-purple. Winter. Malayan region, notably Java. G.C. III. 7:297; 14:15; 22:145, 147; 13:1. B.M. 5157.—This magnificent plant, one of the very largest of its family, has been well-named the "Queen of Orchids." A huge individual growing on a tree in the open at the Botanical Garden of Buitenzorg, Java, has the following dimensions: diameter of whole plant, 18 ft.; collar about the trunk of the tree formed by the closely interwoven roots 7½ ft. in diameter, 2½ ft. thick, and over 3 ft. high: flower-clusters (appearing at the same time) 50–60, each 2 ft. or more in length and bearing 70–100 flowers. And it must be remembered that this huge plant is an epiphyte! Temperature, especially soil temperature, should be carefully regulated in growing this plant. Owing to the brighter light, it does better in American than in European hothouses.

AA. *Pseudobulbs comparatively short and thick, leafy only at summit.*

B. *Fls. greenish or yellowish, spotted with brown.*

Fenzliànum, Reichb. f. (*G. Measuresiànum*, Hort.). Lvs. 4–6: fl. clusters sometimes 15 at one time, each over 5 ft. long and containing over 60 fls.: sepals and petals narrow, cream color to greenish yellow, tipped and spotted with brown and purple; lip streaked with purple. Apr. Island of Amboina. Philippine Islands(?). J.H. III. 29:123. G.M. 34:334.—The fls. are smaller and the spots fewer and smaller than in Rumphianum.

Rumphiànum, Miq. (*C. Guilèlmi II*, Kränzlin). Pseudobulbs 6–8 in. long, ovoid or fusiform: lvs. 1–2 ft. long: raceme nodding or hanging, 3–4 ft. long from the base of the stalk: fls. often 30–35, 3 in. in diameter, green outside, green blotched with brown-purple within; sepals and petals similar; lip purple-veined, downy. Molucca Islands, Borneo, New Guinea, and (?) the Philippines. B.M. 7507.—A large, showy species.

BB. *Fls. brown, streaked with green.*

multiflòrum, Lindl. Lvs. 3–4: fl. clusters nearly 2 ft. long. Summer. Philippine Islands. P.M. 6:217.—This very desirable species has not yet found its way into American trade. It is easily grown, either in a pot filled with a well-drained "compost of heath soil and potsherds," or merely fastened to copper wire and hung from the roof.

G. Éllisii, Lindl.=Grammangis Ellisii.—*G. indeterminàle*, Hort.=?—*G. leviòtum*, Hort.=? T. H. Kearney, Jr.

GRANADILLA. Consult *Passiflora.*

GRAPE. The Grape is probably the oldest of domesticated fruits. It is probable that wine was made from it before the species was brought into cultivation. It seems to have been cultivated at the dawn of history. Its product was certainly no rarity in Noah's time. The Grape of history is the Old World *Vitis vinifera*, the "wine-bearing Vitis," probably native to Asia. The paramount use of the Grape always has been the production of wine. A subsidiary value is the production of raisins; and another is the production of fruit for the dessert and for culinary uses. Great efforts were made to introduce the cultivation of the European Grape into the American colonies, but the efforts resulted in failure. It was not until the latter part of the present century that the chief causes of this failure became known: the depredations of the phylloxera and mildew,—and even then the causes were discovered largely because these enemies had made incursions into the vineyards of Europe. In the meantime, one or two of the native species of Vitis had been ameliorated, and American viticulture had become established on a unique and indigenous basis, and the fruits are grown to eat rather than to drink. So fully did the early American ventures follow European customs that the Grapes were usually planted on terraced slopes, as they are on the Rhine and about the continental lakes. Even to this day the terrace ridges can be traced in some of the slopes about Cincinnati, where Longworth and others cultivated the Grape fifty years and more ago. Those early experiments finally failed because of the incursions of the black rot.

949. The Labrusca or Fox-Grape type. *a*, Niagara; *b*, Brighton

950. The Labrusca type of Grape, comprising most of the common American varieties.

Of all countries, North America is richest in species of Vitis (see the article *Vitis*). These species range from ocean to ocean and from the British possessions to the tropics. The species which has been most improved is *Vitis Labrusca* of the Atlantic slope, although it seems to possess less native merit than some of the southwestern species-types. Of this species are the Concord and Catawba types (Figs. 949–951). To some extent it has been hybridized with *Vitis vinifera* (as in Agawam, Lindley, Barry, and others of E. S. Rogers' varieties), and with native species. Already a number of the popular varieties represent such wide departures that they cannot be referred positively to any species. Of these, Delaware and Isabella are examples. The second most important species, in point of amelioration, is *Vitis æstivalis*, from which several of the best wine Grapes have sprung (Fig. 952). The Post-oak Grape (*Vitis Linsecomi*, or *V. æstivalis*, var. *Linsecomi*) of the Southwest, is one of the most promising species, and already has given excellent results in hybridization. See Figs. 953, 954. *V. rotundifolia* of the South has given the Scuppernong and a few less known forms. Beyond these species, there are none which have given varieties of great commercial importance, although considerable has been done in improving them. Some of the best of the wild species are practically untouched; there is only a comparatively small area of our great country which has yet developed large interests in Grape-growing: the Grape-types of a century hence, therefore, may be expected to be very unlike the present day varieties. For an extended sketch of American Grape history, see "Evolution of Our Native Fruits." The American Grape literature is voluminous. Fifty authors have written on the subject. Yet there is very little of this writing which catches the actual spirit of American Grape-growing; this fact, together with the intrinsic intricacy and diversity of the subject itself, makes it seem wise to devote considerable space to the Grape in this Cyclopedia.

While the native Grape was being ameliorated in the East, the Old World *Vitis vinifera* was becoming established on the Pacific slope. In fact, *Vitis vinifera* has there run wild. The phylloxera and mildew are not native there, and the climate better suits the species. The Pacific coast viticulture, therefore, is of the Old World kind. Wine is the leading revenue of the Grape.

We now know that the phylloxera or root-louse can be evaded when the vinifera Grape is grafted on native or resistant stocks, and the mildew can be combated by fungicides. Of late years, therefore, new efforts have been made to grow the wine Grape in the eastern states, and in the southern latitudes some of these experiments promised well for a time. However, so great attention is required in order to produce a satisfactory product as to discourage the growing of vinifera varieties in the open in the East. Vinifera types will always be special Grapes in the East, adapted only to particular conditions, for it is not to be expected that they can compete with

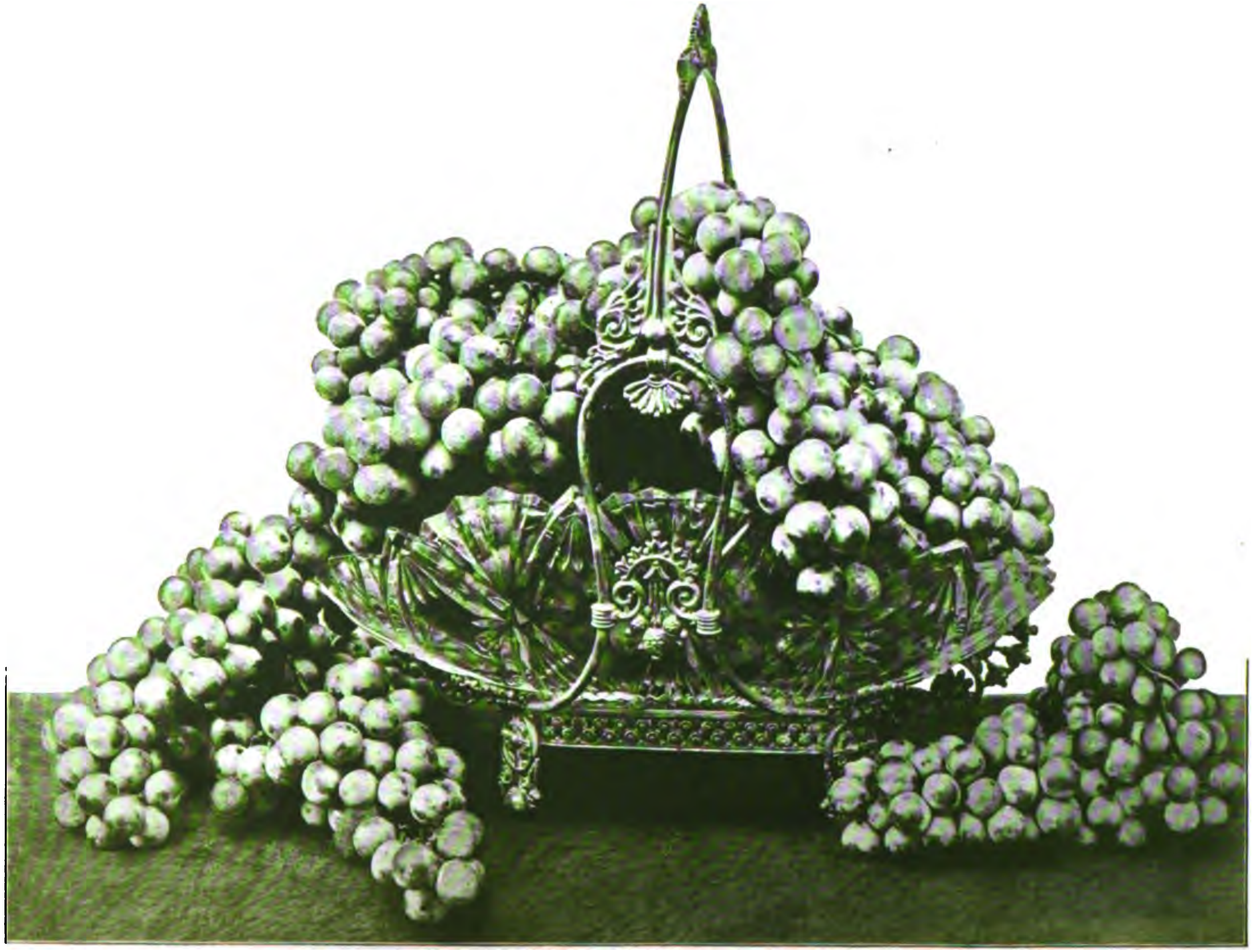


Plate XII. The American Grape, product of plant-breeding from native species within a century.

the more easily grown and cosmopolitan native varieties. Under glass, however, the vinifera varieties thrive; below a special discussion is given to this branch of the subject.

The greatest development of the native Grape industry has taken place in New York and Ohio, bordering lakes and large streams. These areas are the lower Hudson river valley; the region of the central-western New York lakes; the Lake Erie region of New York, Pennsylvania and Ohio. There are also important Grape interests in Ontario, Michigan, and other northern parts. There is considerable interest in Grape culture in the cooler parts of Georgia and Alabama, and there are enlarging areas in the country extending from the Ozark region southward. Nearly all the country, excepting the northernmost parts, raises Grapes, but in most cases the growing of them cannot be said to be extensive enough to be called an industry. Although the Grape sections of the North hug the water areas and the land, therefore, is often steep, all Grape growers prefer nearly level land. The Old World plantations are largely on very steep lands; such lands, by virtue of their warmth and drainage, are thought to give an extra quality of wine. These ideas were brought to this country, and many of our early vineyards were planted on terraced slopes. But we grow Grapes for a different purpose from the Europeans, and land is cheap and labor is dear. Old World methods cannot be followed in the American commercial plantations.

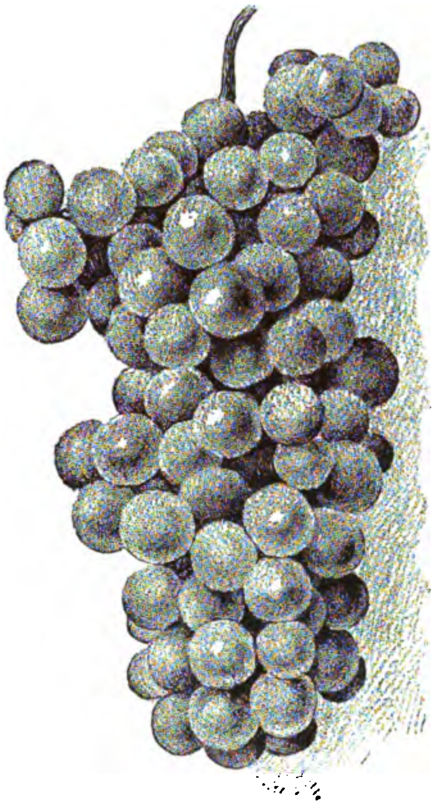
The ideal bunch of Grapes is one which is of medium size for the variety, compact, uniformly developed and ripened throughout, containing no small or diseased berries, and with the bloom intact. A very dense or crowded cluster is not the most desirable, for all the berries cannot develop fully, and the cluster is not easily handled when the fruit is eaten. Fig. 955 shows a cluster of good shape and compactness; Fig. 956 is too broad and irregular; Figs. 957 and 958 are rather too dense and compact.

The American Grape is essentially a dessert fruit. It is eaten from the hand. There are several manufactured products, but, with the exception of wine, they are yet of minor importance. Americans are not a wine-drinking people, and wine is a secondary output of the Grape in the eastern states, although there are many large wine-cellars in New York and Ohio, and the product is of excellent quality. Unfermented grape juice is a product which deservedly is growing in popularity. The lack of secondary domestic uses of the Grape is one reason for the very serious gluts in the markets. However, one year with another, the profit on a good vineyard may be expected to exceed that on the staple farm crops.

951. Champion, one of the early-season Labruscas, but of poor quality (× ¾).

The American book literature of the Grape is nearly as large as that of all the tree fruits combined. Probably 100 books, counting the various editions, have been published in North America since Adlum's volume in 1823 (see "Evolution of Our Native Fruits," pp. 117–126). The earlier books were founded largely on European practices. The leading current works are: "Bushberg Descriptive Catalogue and Grape Growers' Manual;" Mitzky's "Our Native Grape;" Fuller's "Grape Culturist;" Husmann's "American Grape Growing and Wine Making." For the Pacific slope, Husmann's "Grape Culture and Wine Making in California," Wickson's "California Fruits," and Eisen's "Raisin Industry" are current guides. Detailed discussions of pruning and methods of training are contained in "The Pruning-Book." A standard European monograph is Foëx's "Cours Complet de Viticulture."

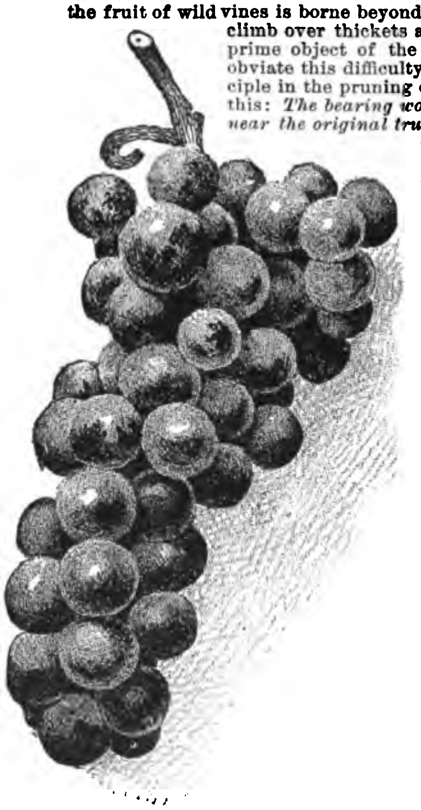
Pruning and Training.—A Grape vine is pruned in order to reduce the amount of wood (that is, to thin or to limit the amount of fruit), and to keep the plant within manageable shape and bounds. A vine is trained in order to keep it off the ground, out of the way of the workmen, and to so arrange the fruit that it will be well exposed to light and air. In order to understand the pruning of Grapes, the operator must fully grasp this principle: *Fruit is borne on wood of the present season, which arises from wood of the previous season.* To illustrate: A growing shoot, or cane of 1899, makes buds. In 1900 a shoot arises from each bud; and near the base of this shoot the Grapes are borne (1 to 4 clusters on each). This is shown in Fig. 959. The 1899 shoot is shown at the top. The 1900 shoot bears 4 clusters of Grapes. While every bud on the 1899 shoot may produce shoots or canes in 1900, only the strongest of these new shoots will bear fruit. The skilled Grape grower can tell by the looks of his cane (as he prunes it, in winter) which buds will give rise to the Grape-producing wood the following season. The larger and stronger buds usually give best results; but if the cane itself is very big and stout, or if it is very weak and slender, he does not expect good results from any of its buds. A hard, well-ripened cane the diameter of a man's little finger is the ideal size.

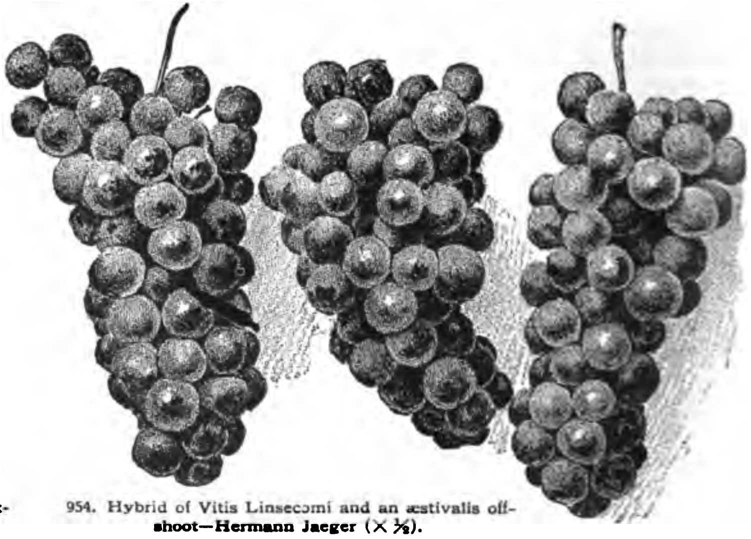


952. Horticultural product of Vitis æstivalis—Onderdonk, seedling of Herbemont (× ⅝).

The second principle to be mastered is this: *A vine should bear only a limited number of clusters,*—say from 30 to 80. A shoot bears clusters near its base; beyond these clusters the shoot grows into a long, leafy cane. An average of two clusters may be reckoned to a shoot. If the vine is strong enough to bear 60 clusters, 30 good buds must be left at the annual pruning. How much a vine should be allowed to bear will depend on the variety, distance apart of the vines, strength of the soil, age of the vine, system of pruning, and the ideals of the grower. The Concord is one of the strongest and most productive of Grapes. Twelve to 15 lbs. is a fair crop for a mature vine; 20 lbs. is a heavy crop; 25 lbs. is a very heavy crop. An average cluster of Concord will weigh ¼-⅓ lb. The vine may be expected to carry from 30 to 60 clusters; and the annual pruning will leave from 15 to 30 buds.

Since the bearing wood springs from new canes, it follows that the fruit of the Grape is each year borne farther from the main trunk of the vine. Observe that the fruit of wild vines is borne beyond reach when they climb over thickets and trees. It is a prime object of the Grape-grower to obviate this difficulty. The third principle in the pruning of Grape vines is this: *The bearing wood should be kept near the original trunk or head of the vine.* When one cane is sending out fruit-bearing shoots, another shoot is taken out from near the main trunk or head to furnish fruit-bearing shoots for the next year; and the other or older cane is entirely cut away after the fruit is off. That is, the wood is constantly renewed; and the new shoots which are to give bearing wood the following year are called *renewals*. There are some systems of Grape training which renew back to the root every year or two, and these have been called renewal systems; but every system of Grape pruning must practice renewal in one way or another.

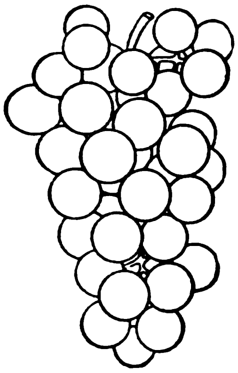

953. Hybrid of Vitis Linsecomi and a Fox-Grape derivative—Husmann (× ⅝).


954. Hybrid of Vitis Linsecomi and an æstivalis offshoot—Hermann Jaeger (× ½).

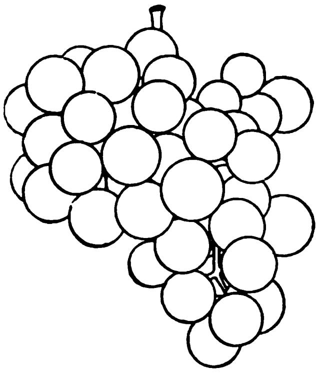
An old system of renewal was by means of spurs. Fig. 960 illustrates this. The horizontal part is a permanent arm or branch. We will suppose that it grew in 1890. In 1891 a shoot grew upward. It bore two or three clusters of fruit. In the fall it was cut back to *a*, two buds being left to supply the shoots of the succeeding year. This short branch is now called a *spur*. Only one shoot was wanted for the next year, but two buds were left in case one should be injured. In 1892, a branch grew from one of these buds: it bore fruit: in the fall it was cut back to *b*. In 1893 a shoot will grow from one of the buds, *c*. Thus the spur elongates year by year, becoming a forking, complicated, stubby branch. After a few years it may become weak: the grower sees this, and if a new shoot should start from the main arm near the base of the spur, he encourages it and cuts off all of the old spur: thus he renews back again to the main vine. Shoots from adventitious or secondary buds are likely to spring from the main arm or the spur at any time. These are usually weak and are removed, but now and then a strong one arises. Spur pruning is now rarely used except in Grapes grown on arbors or under glass, in which cases it is necessary to have a long, permanent trunk. On arbors it is best to carry one arm or trunk from each root to the top of the framework. Each year the lateral canes are cut back to spurs of two or three buds. The pruning of glasshouse Grapes is discussed under *Grapes under Glass*.

The current systems of pruning renew to a head—or to the main trunk—each year. The trunk of the vine is carried up to the desired height—to one of the wires of the trellis—and one or more canes are taken out from its top each year. The object is to keep the bearing wood near the main trunk and to obviate the use of spurs. This type of pruning is illustrated in Fig. 961. This engraving shows the head of a vine seven years old, and on which two canes are allowed to remain after each annual pruning. The part extending from *b* to *f* and *d* is the base of the bearing cane of 1892. In the winter of 1892-3, this cane is cut off at *d*, and the new cane, *e*, is left to make the bearing wood of 1893. Another cane sprung from *f*, but it was too weak to leave for fruiting. It was, therefore, cut away. The old stub, *b*, *f*, *d*, will be cut away a year hence, in the winter of 1893-4. In the meantime, a renewal cane will have grown from the stub *c*, which is left for that purpose, and the old cane, *b d*, will be cut off just beyond it, between *c* and *f*. In this way, the bearing wood is kept close to the head of the vine. The wound *a* shows where an old stub was cut away this winter, 1892-3, while *b* shows where one was cut off the previous winter. A scar upon the back of the head, which does not show in the illustration, marks the spot where a stub was cut away two years ago, in the winter of 1890-1. This method of pruning can be kept up almost indefinitely, and if care is exercised in keeping the stubs short, the head will not enlarge out of proportion to the growth of the stock or trunk.

There are two common styles of training in use in the northern states, but each of them practices essentially the system of renewals which is described in the last paragraph. One style of training carries the trunk only to the lowest wire of the trellis. The canes—usually 2 in number—are tied horizontally on the bottom wire, and the bearing shoots are tied, as they grow, to the two wires above (Fig. 962). This is an *upright system*. The other style carries the trunk to the top wire. The canes are tied on the top wire, and the bearing shoots hang. This is the *drooping* or *Kniffin system*. If the shoots run out on the top wire by clinging to it by tendrils, they are torn loose, so that they will hang: this is a very necessary practice. There is controversy as to the comparative merits of these systems, which proves that



955. Grein Golden.



956. Eaton.

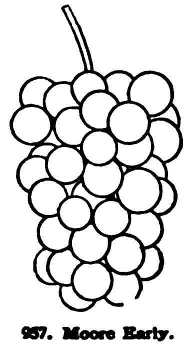
A good Grape cluster.

each has merit. It is probable that the upright system is better for the slender or shorter varieties, as Delaware, and also for those whose shoots stand erect, as Catawba. The Kniffin has distinct merit for strong-growing varieties, as Concord; it is also cheaper, since it requires no summer tying. Grape-training is a very special subject; it is discussed at length, with many illustrations, in "The Pruning-Book."

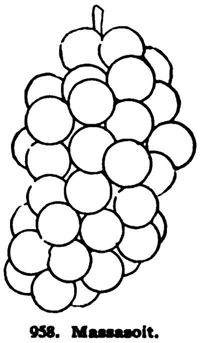
One- or 2-year-old vines are planted either in the fall or early spring. At planting, the vine is cut back to 3 or 4 buds and the roots are well shortened. If all the buds start, the strongest one or two may be allowed to grow. The canes arising from this bud should be staked and allowed to grow through the season; or in large plantations the first-year canes may be allowed to lie on the ground. The second year this cane should be cut back to the same number of eyes as the first year. After growth begins in the second spring, one of the strongest shoots should be allowed to remain. This cane may be grown to a single stake through the second summer. At the end of the second year the cane may be cut back to the bottom wire of the trellis, if upright training is to be employed. The cane may be strong enough at this time to be made the permanent trunk of the Kniffin training, but in most cases the trunk is not carried to the top wire until the third year.

The main pruning is performed when the vine is dormant. The ideal time is January and February in the North, although the work is often begun in November if the area is large. Pruning in spring causes the vine to bleed, but bleeding is not injurious. But late pruning interferes with tillage, and the buds are likely to be injured after they are swollen. Summer pruning is now practiced only to the extent of pulling out suckers and weak shoots, and even this is not always done. Heading-in the vine in summer is likely to start side growths, which are useless and troublesome.

Propagation.—The Grape grows readily from seeds which may be kept over winter and germinated in the house early in the spring. They may be even planted in beds in the open, but the proportion of failures will be greater. Seeds produce new varieties, and they are used only in an experimental way.



957. Moore Early.

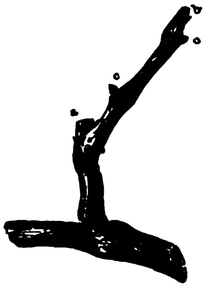


958. Massasoit.

The commercial propagation of Grapes is done by means of hardwood cuttings. These cuttings are taken in the winter from the trimmings of vineyards. In all ordinary cases they are made of two or three buds' length, preferably three (Fig. 963). They are cut as soon as the canes are trimmed, tied in small bundles, and these bundles are then buried half their depth in damp sand in a cool cellar. By spring the cuttings will be more or less callused. The cuttings are planted in the open on the approach of warm weather. A loose, loamy soil is selected, and it is well and deeply prepared. The cuttings are inserted until only the upper bud stands at the surface of the ground. These cuttings are placed 6 to 8 inches apart in rows, and the rows are far enough apart to allow of horse cultivation. These cuttings may give plants large enough for sale the following fall; but it is usually preferred to let the plants grow two years before they are put upon the market. In such cases it is customary, in many of the best nurseries, to transplant at the end of the first season. When wood is scarce, the canes are sometimes cut to single eyes. In this case about an inch of wood is left on either side of the bud. Single-eye cuttings are nearly always started under glass, preferably on the greenhouse bench. If they are started in February, they will be large enough for transplanting in a well-prepared seed-bed very early in the spring. Green wood cuttings are sometimes used in the summer time with new and rare varieties, but they are not in general favor. In California, rooted vines of one year are preferred; and in soil in which cuttings root readily, they are sometimes planted directly in the vineyard.

959. Fruit-bearing of the Grape.

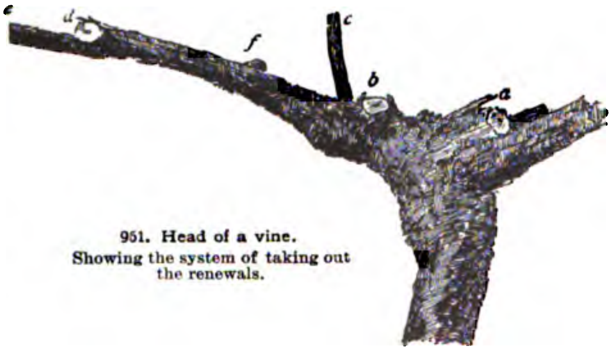
The Grape is easily grafted. Because of the flexible nature of the vine, however, it is customary to make the graft below the surface of the ground. An ordinary cleft-graft is the one which is usually employed. The whole vine is cut off 4 or 5 inches below the surface, and the graft is inserted in the same fashion as in apple or pear trees. The surface may then be waxed or covered with clay or other material, to keep the water out of the cleft, although if the earth is firmly packed around the graft and no water stands, the union may be perfectly satisfactory without any cover (Figs. 964-5). Vines of any age may be grafted. It is important that the cions be perfectly dormant. These cions are taken and stored in the same way as cuttings. The grafting should be done very early in the spring, before the sap starts. Grafting may also be done late in the spring, after all danger of bleeding is over; but, in that case, it is more difficult to keep the cions dormant, and the growth is not likely to be so great during the first season. Vineyards which are composed of unprofitable varieties may be changed to new varieties very readily by this means. Vinifera varieties can also be grafted on our common phylloxera-resistant stocks by the same method. Almost any method of grafting can be employed upon the Grape vine if the work is done beneath the surface.



960. Pruning to a spur.

Diseases.—The Grape is amenable to many insect and fungous attacks. The most serious difficulty is the phylloxera, which, however, is practically unknown as an injurious pest on the native Grapes. On the vinifera varieties it is exceedingly serious, and it is working great devastation in many of the vineyards of the Old World and of the Pacific coast. The most practicable means of dealing with this pest is to graft the vinifera vines on native or resistant roots.

The mildew and black rot are the most serious of the fungous enemies. The mildew (*Peronospora viticola*) is the more common form of rot in the North. In the South the black rot (*Læstadia Bidwellii*) is very serious. Both these diseases cause the berries to decay. They also attack the leaves, particularly the mildew, causing the leaves to fall and preventing the Grapes from maturing. It is the mildew which has worked such havoc in European vineyards. The mildew is most serious on thin-leaved and smooth-leaved varieties, as the Delaware. It causes yellowish patches to appear on the leaves, with frost-like colonies on the under sides. It causes the berries to decay with a gray and finally a brown rot, the berries usually remaining small and firm but not greatly wrinkled. The black rot causes the berries to become very hard, dry and shriveled, and the epidermis is covered with minute pimples (Fig. 966). The treatment for both these diseases is the same—spraying with Bordeaux mixture. In regions in which the diseases have not been very prevalent, it is usually sufficient to begin the spraying after the fruit has begun to set, and to spray two or three times, as the case seems to require. When the diseases have been very prevalent, however, it is better to begin before the buds swell in the spring. In infested vineyards, the foliage and diseased berries should be raked up and burned in the fall.



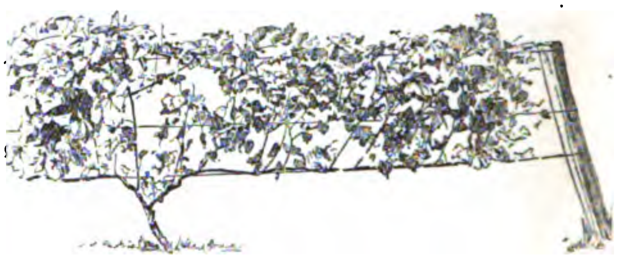
951. Head of a vine.
Showing the system of taking out the renewals.

The anthracnose or scab (*Sphaceloma ampelinum*) is a very serious fungous disease. It is most apparent on the fruit, where it makes a hard, scabby patch. Its most serious work, however, occurs on the stems of the clusters and on the young growth, where it makes sunken, discolored areas, and where it interferes seriously with the growth of the parts. It is not so easily controlled as the mildew and the black rot. Careful attention to pruning away all the diseased wood and burning it will help in controlling the disease. Before growth starts, spray the vines, trellis and posts with strong sulfate of copper solution. After the leaves open, use the Bordeaux mixture.

In Grape houses the powdery mildew (*Uncinula spiralis*) often does serious damage. It also occurs in the open vineyard, but it is usually not serious there. It appears as a very thin, dust-like covering on the leaves. It sometimes attacks the berries, causing them to remain small or to crack. This fungus lives on the surface, and is therefore readily controlled in Grape houses by dusting with flowers of sulfur or by the fumes of evaporated sulfur.

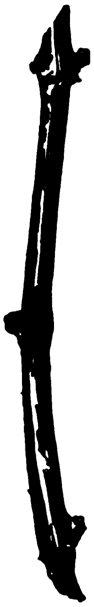
For further discussions on Grape diseases and difficulties, the reader should consult the bulletins of the experiment stations, publications of the Department of Agriculture at Washington, books on economic entomology, and Lodeman's "Spraying of Plants."

Varieties.—Of the native Grapes, fully 800 varieties have been named and described. Many foreign varieties have been introduced. Yet, in any region the number of useful commercial varieties is usually less than a dozen. Of the American Grapes (those aside from viniferas), the Concord is the cosmopolitan variety. Others of great prominence are Worden, Niagara, Catawba, Delaware. For the South, consult Munson's article, below. For the Pacific viniferas, consult Wickson's account, below. Following are notes on varieties by Ralph Bush, of the old firm of Bush & Sons, Bushberg, Mo. This firm was established shortly after the civil war by Isidor and Ralph Bush, father and son. In the early seventies the firm became Bush & Son & Meissner, by the entering of G. E. Meissner. The recent death of the elder Bush and Meissner has left the firm in the hands of Ralph Bush & Sons. It is this firm which publishes the Grape manual already mentioned. In that work and in Mitzky's "Native Grape," great numbers of varieties are described. Mr. Bush's remarks on varieties of Grapes, made for this occasion, are as follows:



962. Upright system of Grape training.
At the winter pruning, all the top will be cut away except two canes near the center: these two will be laid down in opposite directions on the bottom wire for the next season's fruiting.

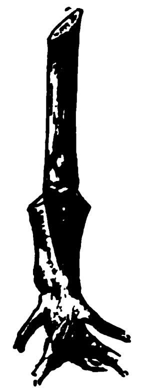
"The planting of vineyards, both for market and amateur purposes, is on the increase. The inclination in planting tends more towards quality than to quantity: that is, from the many inquiries and orders, the main question seems to be the adaptation of the variety to the soil or the purpose. In former years the planter, without question, would order so many Concord, Hartford, Ives, Elvira, etc., and in rare cases, one or two of a better variety. Now there is no demand whatever for Hartford, much less for Ives and Elvira, while the planting of even the Concord is on the decrease. The general tendency around the great lakes is still to plant the Catawba, and it certainly thrives very well. In many parts of Ohio, Indiana, Kentucky and Tennessee the Noah and Niagara are in great demand; as also the Delaware, Norton Virginia and Cynthiana for wine purposes. In the section south of the Ohio river, as also in the western states, such kinds as Moore Early, Moore Diamond, Brighton, Worden, Cottage, Niagara, and many of the Rogers hybrids are now planted. In the southern states, from Texas to Georgia, the Niagara, Herbemont, Cunningham, as also Norton Virginia and Cynthiana, are most frequently wanted." L. H. B.



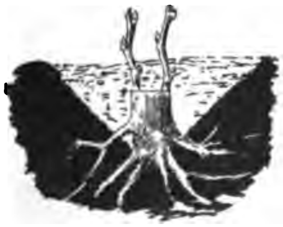
963. Common 3-bud cutting of Grape.

Grapes in the North.—Seeking a proper location for Grapes in the northern states east of the Rocky mountains, one should make a distinction between Grapes planted for commercial purposes and those planted for domestic use. If for the former, the climatic conditions must be so perfect that a crop can be depended on each season with the same certainty as the appearance of the tax collector or the annual interest on the mortgage. If for the latter, the chances may be such as to give a yield of Grapes three years out of five, which is better than no Grapes at all. Any section in which dent corn has a liberal season in which to mature is a practicable place for a household vineyard, provided the early ripening varieties are selected. For this purpose, for black or deep purple, may be suggested Moore Early and Worden. During the past three years the Campbell is often favorably mentioned. For white or pale green, the Green Mountain, sometimes called the Winchell, and for red the Brighton, are good varieties.

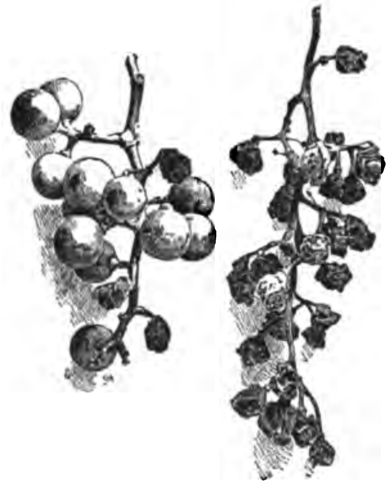
The best location for a commercial vineyard is along the shores of our lakes or large rivers. The advantage of such locations is due almost entirely to protection from late and early frosts. During the early development of the Grape industry, many loose ideas were prevalent that certain spots within the different Grape zones had some special magic of sunshine, or temperature, or draught of air, or alchemy of the soil, that gave such superior quality of fruit. The earlier vineyards at Hammondsport, N. Y., were planted upon steep hillsides—so steep that terraces were sometimes formed, which made cultivation and harvesting expensive. Such locations were probably considered superior to all others because some one had seen Grapes grown in similar locations along the Rhine. It was also said that the west bank of the lake was superior because the Grapes received the morning sun. Henry O. Fairchild, a pioneer and progressive vineyardist, in time proved the foolishness of the idea by planting a vineyard on the east side of the lake, where the lay of the land made cultivation more easy and the Grapes received the afternoon sun. In later years, when the Grapes from either shore reached the market, no consumer could tell whether the fruit received the morning or afternoon sun. The first vineyards planted in the Lake Erie belt were at Brocton, Chautauqua county. The industry clung about that initial location many years, for it was a popular belief that there was some special current of air passing from the hills to the lake at that special point that did not pass elsewhere. Now there are more than 25,000 acres of vineyard planted between Silver Creek and Harbor Creek, and the yield of that area for the season of 1899 was about 7,000 car loads. The only marked difference of Grape product in all that area is the difference between the conscientious and the careless packer. If there was ever any reason for such an idea as the quality of fruit being influenced by location, it was probably due to the inexperience of some outside planter, which led him to put up too much or too little wood, and imperfect ripening of the fruit was the result. The conclusion was jumped at that the difference was due to a heaven-born blessing of location, instead of good judgment in pruning. It is the common thing for writers to lay much stress on "southern slopes" and "sunny slopes," but in most cases they have said so because some one has said so before them, and not because they spoke from experience. Scarcely an acre of the 25,000 planted to vineyards in the Chautauqua belt but faces the north, and is in full view of Lake Erie, as the seats of a theater face the stage.



964. Cleft-grafting the Grape.



965. Cleft-grafting the Grape.

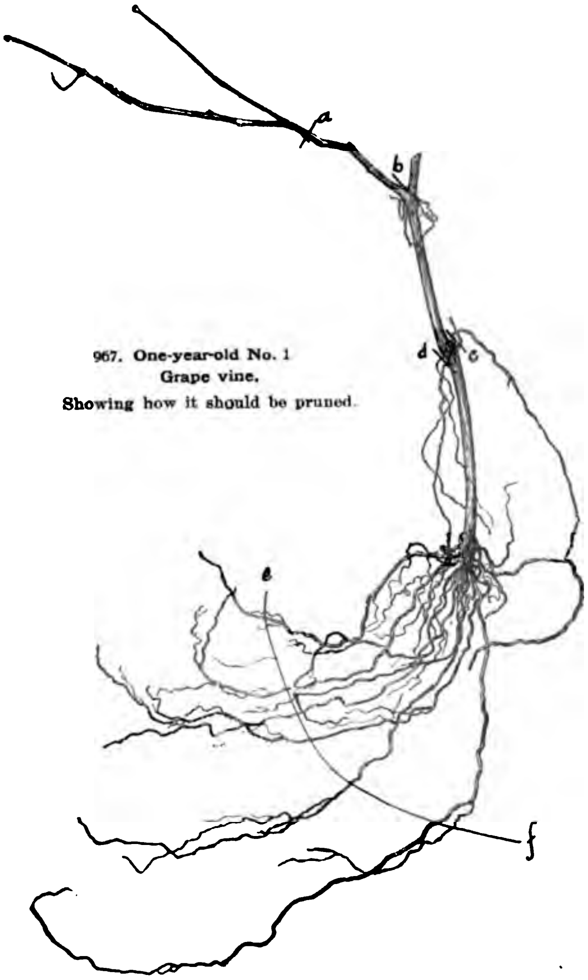


966. Grapes ruined by black rot.

There is one feature of location upon which much stress must be laid, even in the lake zones, and that is opportunity for frost drainage. It is a well attested fact that the cold air settles in the bottom of a valley; therefore, the bottom of a ravine is usually colder in frosty nights than the hillside. It often happens that a late spring or early fall frost will injure Grapes in the lower location, and not on the slopes. This is a factor that planters of all fruit should observe.

There has been as much nonsense written about the best soils for Grapes as there has been about best location. One has a vineyard planted on the gravel of what was once the beach of Lake Erie, when it had a higher level than at present. His neighbor across the road has a vineyard planted on a very stiff clay, which was once the bottom of the lake. One gets just as large yields and just as fine quality of fruit as the other. The only difference is that the former, being on the gravel, is able to work his soil earlier than the latter; his fruit ripens earlier, so that he is able to borrow all of the neighbor's harvesting tools. Another neighbor has a vineyard extending across both clay and gravel, and he would not sell one acre cheaper than another. In commercial planting, the period of protection from frosts should be broad enough so that the difference in ripening from gravel or clay should not make a difference of success or failure. For domestic planting, the gravel would be preferable. The soils of which most serious warning should be given are those containing a very liberal supply of available nitrogen. All experienced fruit-growers know of the impossibility of early fruiting of trees or vines which are making a rampant growth. There is no fruit so easily intoxicated by nitrogen as the Grape. Long-jointed canes are always to be avoided. Besides being less fruitful, a riotous growth of Grape vine is far more liable to mildew and to other diseases than those of sober growth. One of the surprises in the development of the Chautauqua Grape zone is that some of the so-called poor land has given vineyards as productive as any,—land that previously had been given over to sheep pasture, briers and mulleins. This land was poor in nitrogen, but no doubt had a fair supply of available potash and phosphoric acid, which Grapes most require.

In preparing land for vineyard planting, it is necessary to lay great stress on the importance of first removing all trees, stumps and large rocks, for when the trellis is put up all tillage of the soil will be in a straight line and one way. A favorite way of disposing of boulders is to bury them about twenty inches deeper than one thinks necessary, for they have a vexatious way of overcoming the power of gravitation and creeping out of their graves. The real reason for this apparent freak is the compacting of the soil in later years. If any open ditches should cross the line of the Grape rows, they should be supplied with tile and the ditch filled so as to make long "bouts" possible. Short rows and frequent turning should be avoided as much as possible. Turning at the end of a row is lost labor, and the time it occupies would enable a team to cultivate over a hundred feet straight ahead.



967. One-year-old No. 1 Grape vine. Showing how it should be pruned.

The rows in nearly all the commercial vineyards are 9 feet apart, and the vines are planted 8 feet apart in the row. This makes 605 plants per acre. If the land is sod, plow into narrow lands, so that the center of the dead-furrows are 9 feet apart, and plant in the bottom of the dead-furrow When the plow is set to cut a furrow 8 to 9 inches deep, the dead-furrow will have about the required depth for planting. If the ground is stubble, plow the whole field, and then lay out rows by striking a double-furrow. Much care should be exercised to have the rows perfectly straight and to plant the vines straight in the row. This has a practical use, besides appealing to the professional pride of all good farmers. If the plants are not straight in the row, the posts cannot be set straight; and if the posts are not straight the wires composing the trellis will bind on the posts which are out of line, and they cannot be easily tightened in spring.

No. 1 vines, of one season's growth from cuttings, are much to be preferred to No. 2 vines of the same period of growth. A young plant, stunted in growth either by constitutional reasons or accident, has a handicap that usually follows it all through life. For the same reason, avoid planting 2-year-old plants, as often they are the second season's growth of what was a cull the year before. Cull plants and cull men are seldom worth the cost of reformation. Spring planting is universally followed in the North. It should be completed by the last of May. Some vineyards planted during the last half of June have developed into good production, but it was due to the grace of favorable weather and soil. Fig. 967 represents a fair No. 1 Grape vine. The few roots at *d c* should be trimmed, as well as the main body of the roots shown by segment of circle *e f*. The pruning facilitates planting, and the removed parts would make no root growth of value if retained. The stem of the vine can be cut back to two or three buds, as shown by *a b*. Six quarts of well pulverized fertile soil, well packed about the roots, will hold the plant in place and keep it moist until the furrow can be filled by plowing, if on stubble, or by frequent harrowing and cultivating if on sod. During the first season, all cultivation necessary for conservation of moisture should be given. If no tilled crop is planted, this tillage can be done by cultivating or harrowing crosswise alternately. But little hand-work in weeding will be required. Whether some hoed crop be planted between the rows the first season is a question of profit for each vineyardist to decide. It adds something to the expense of cultivation. It is generally no detriment to the growth of the Grape vines. After the first season, the ground should not be planted to other crops.

The general appearance of an infant vineyard at or about the middle of the first season's growth is shown in Fig. 968. Lay great stress upon the importance of a vigorous and even growth during the first and second years. If such is not attained, many years will be required for the vines to recover, and sometimes they never reach the standard of a good vineyard. Even vines planted after the second year to fill vacancies require constant coddling to bring them up to the average. In the spring of the second year the shoots or canes of the previous season's growth should be cut back to three or four buds, and the canes should be thinned out according to the vigor of the vine—one cane for a feeble growth, and three or four for a decidedly vigorous growth. In all other respects, the second year's management should be a repetition of the first.

In the spring beginning the third year will come the most considerable expense of the undertaking—that of putting up the trellis. There are many forms of training Grapes, and some of them so peculiar that special trellises must be constructed. There are three popular styles of Grape training in the commercial Grape fields of the North: Kniffin system, as practiced in the Hudson river valley; the High Renewal system, as practiced along Lakes Keuka, Canandaigua and Seneca; and the Chautauqua system, as practiced along the Lake Erie valley. It is impossible to say which of the three is preferable. A man's preference usually depends on how he was brought up—like his politics and religion. In horticultural meetings, advocates of the various systems argue the merits with much partisan fervor. It is clear to me that the essential point to be attained in any system is to hang up the vines so that fruit and foliage can obtain the greatest amount of air and sunshine, all of which can be secured by several methods. The common form of trellis may be illustrated by a high

968. A vineyard in its first summer.

wire fence, as shown in Fig. 969; but the Kniffin system omits the bottom wire.

The vineyardists of the Chautauqua Grape belt have developed a mode of pruning and training of Grapes which has many features peculiar to that district. The trellis is made of two wires, of No. 9 or No. 10 gauge, and chestnut posts. The posts are from 6 to 8 feet in length, and cost 1 cent per lineal foot at the railroad station. In later years, since experience has shown how important air and sunshine are in ripening the fruit, 8-foot posts are most commonly used. Grape posts should be somewhat heavier than those commonly used for wire fence—from one-third to one-half larger—and the heaviest should be sorted out for the end posts, for these bear the strain of the wire. An experienced farmer need not be told that they should be sharpened with a true lead-pencil taper, excepting the crooked ones, which should be so beveled as to counteract the crook in driving.

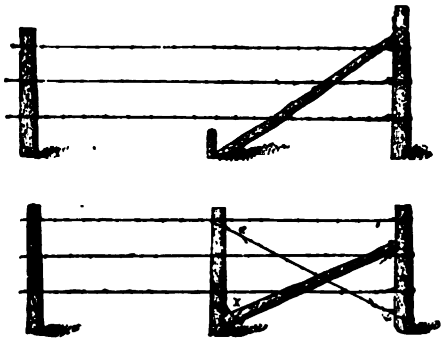
The usual distance apart for the posts in the row of Grapes is one post to every three vines, or, in other words, 27 feet, and for ease in stretching the wire, they should be in as straight a line as possible. The posts are driven, but a hole should first be made by an unusually large crowbar with a bulb near the lower end. After the posts are stuck into the holes, they are most conveniently driven by the operator standing in a wagon which is hauled through the row by a horse. A fair weight of maul is 12 pounds, and it requires a good man to swing one of that size all day. Iron mauls are commonly used because they are the cheapest, but one with an iron shell filled with wood "brooms" or frays the top of the post less than the iron maul. Eighteen inches is a fair depth to drive the posts on most soils. If the proprietor delegates the driving to another man, he would better direct that 20 to 22 inches be the proper depth, for to the man swinging the maul the post seems deeper than it really is.

A vineyard should have a break or an alley at right angles to the rows as often as every 50 Grape vines, for the purpose of dumping Grape brush and shortening the trip when hauling fruit. If the vineyard is in fair thrift, longer rows will give so much brush as to be inconvenient in hauling out.

The end posts should not only be the largest of the lot, but should also be well braced. The most common mode is the "hypotenuse brace," consisting of a stiff rail or a 4x4 scantling 12 feet long, with one end notched into the post about midway between the two wires, and the other end resting on the ground against a 2-foot peg of about the same size as the end post.

The wires (two wires in the Chautauqua trellis) should be strung on the windward side of the post; that is, on the side from which the prevailing winds come. This is very important when the wind is blowing at 30 to 40 miles an hour, and the vines have sails of many square feet of foliage, and perhaps three and four tons of fruit per acre. The staples should be of the same gauge of wire as that used in barbed wire fences, but about one-half inch longer, unless the Grape posts should be of hard wood, like locust; then fence staples will be long enough. The bottom trellis wire is usually placed from 28 to 32 inches from the ground. Owing to the arm system of pruning in the Chautauqua Grape belt, the height of the lower trellis wire is permanent. The upper trellis wire is, in many instances, raised as the vineyard comes to maturity. The first year of fruiting it may not be more than 24 inches above the lower wire, and year by year be raised to 30 and 32 inches. It is not advisable to go more than 36 inches apart without putting in a middle or third wire. Each spring many of the posts will sag, and the upper wire will be slack, and many of the braces will be out of place. All of these faults should be corrected just before tying up the canes in spring.

A large part of the pruning is done in the winter months—some beginning in the fall soon after the crop is harvested. Two grades of labor can be employed in this operation—the skilled and the unskilled. The man of skill, or the expert, goes ahead and blocks out. He stands in front of a vine of far more tangled brush than that seen in Fig. 962, and, at a glance, tells by a judgment ripened by much observation, just how many buds are required to ballast and not over-ballast the vine for another year. As the expert stands before the vine making the estimate, he might be likened to a man weighing a ham with steelyards, pushing the weight backward and forward, notch by notch, finding the point of balance. The expert, with his pruning shears, makes a dive here and a lunge there, a clip at the bottom and a snip at the top, and with a few more seemingly wild passes all wood is severed from the bearing vine, but the number of buds desired to give fruit another year are left. The unskilled help, who receives possibly a dollar a day less than the expert, follows the expert, cutting the tendrils and other parts of the vine that are attached to anything but the trellis. The next process is "stripping" the brush, and it is one involving brute force, ragged clothes and leather mittens. If the laborer does not put on a ragged suit, he will be apt to have one before he is done with his job. There is a little knack even in doing this work to the best advantage. The dismembered vines still hang to the upper trellis and often cling with considerable tenacity, and a particular jerk or yank, more easily demonstrated than de-

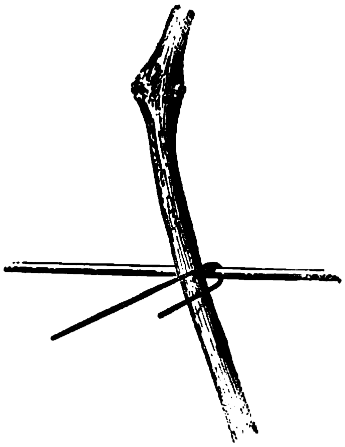


969. Illustrating the bracing of the end post in a fence or trellis.

scribed, is most effectual to land the brush on the ground between the rows.

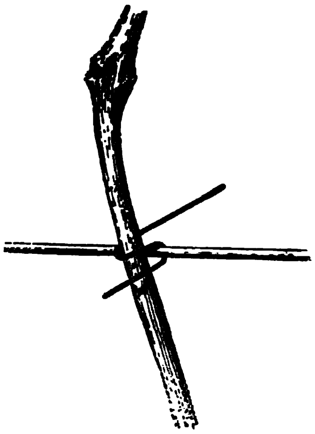
The next operation is to haul the brush to the end of the row. Many tools have been devised for this purpose, some of them involving considerable expense. It is now the general practice to use a simple pole—one a little larger than would be used to bind a load of logs, and not so large as required in binding a load of hay. It may be a sapling about 4 inches at the butt and 2⅛ inches at the top, and 10 to 12 feet long. The small end is to be held in the right hand, and the butt end to be pushed along the ground. A horse is hitched to this pole by a rope drawn through an inch hole about 4 feet from the butt or ground end. When starting at the end of the row, it seems that the straight pole would not gather any brush at all. It is a question of catching the first wad, and all the rest of the brush will cling to it. At the end of the row the brush is hauled to a convenient pile, where it is to be burned, and is dumped by letting the end of the pole held in the hand revolve over towards the horse. If the pole hits the horse, the operator will see that there is not enough stretch of rope between the pole and whiffletree, and more must be provided.

Tying is done by women, boys and girls, and cheap men. The tying materials are wire, wool-twine, raffia, willow and carpet-rags. The horizontal arms, at the lower wire, are more or less permanent, and they are loosely confined to the wire, always by string or willow. The vertical canes, which are fastened to the top trellis, are now commonly tied with annealed wire of No. 18 gauge, and cut in lengths of 4 inches. The economy in using the wire is the despatch in tying, and the fact that the work can be done on cool days when light gloves are necessary. The use of wire has been strenuously opposed by people who have never used it. The objection has been that the fine wire would chafe the cane so that the cane would break and fall from the trellis. Such instances occur rarely, and when they do it is so late in the season that the tendrils of the vine are ample to hold it to the trellis. The cane should be tied to the windward side of the wire for the same reason that the wire was stapled on the windward side of the post. In using the wire tie, the operator stands on the opposite side of the trellis from the cane, and follows the movements as illustrated in Figs. 970–973. This operation puts on the wire with the fewest number of movements, binds the cane snug to the trellis, and makes a loop that falls from the trellis on the following season, when the cane is torn away. The tying wire should be thoroughly annealed, so that it can be easily bent and give no springy reaction after being worked. This wire is also useful in tying thorny shrubs to a trellis when a mittened hand is necessary to hold the branches in place while the other hand makes the tie.



970. Tying with wire. The first movement.

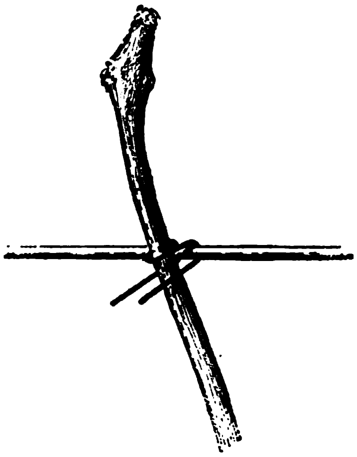
To recommend varieties is a difficult and personal matter. Grapes, like most other fruits, are influenced in character by difference of location. There are many more Concords sold than any other variety, yet by the fastidious Grape eater it is thought far inferior to many other varieties. However, as it is the sort the public most want, and is a good yielder, it is probably the most profitable to plant. For the past few years many have wished that all their Concords were Niagara, for the reason that the yield of the latter has been good and the crop brought at least ten dollars per ton more when sold in bulk. Perhaps this condition is only temporary. The Catawba is of excellent flavor; it is latest to ripen and an excellent variety for storage. When placed in good cellars, and an even low temperature is maintained, but not low enough to freeze, this variety will keep in good shipping condition until the last of March and first of April. These are standard commercial varieties in New York and Ohio. Worden is excellent for a near-by market, but does not stand long journeys well.



971. The second movement.

Many fruits are better picked before fully ripe, of which the pear is a conspicuous example. Grapes have not that characteristic, for no maturing development goes on after the fruit is harvested. As soon as the full ripening period has been reached, the clusters should be gathered by carefully cutting and placing in trays which hold from 25 to 35 pounds. The care in handling should almost equal that taken with eggs. After picking, the fruit should be placed in a fruit house built upon the principle of an ice house, but so arranged as to give free access to the cooling night air, and to be closed each morning to protect from the heat of the day. By such means the temperature can in time be worked down to 40°, which checks excessive evaporation, thereby keeping the stems green and the fruit plump. This is the ideal method, but is far from being attained or even sought in many large commercial districts. The practice is far more closely observed in the Lake Keuka (N. Y.) and adjacent lake districts than in the Chautauqua district. In the former locality many Concords are stored in this manner and shipped in fine condition during November and December, and Catawbas during the balance of the winter. In the latter district the fruit is sent almost direct from the vine to the consumer. This directness means haste and carelessness that is much to the detriment of the Grapes when they reach the market.

From 1893 to 1899 the price of Grapes steadily declined, and with the decline came a casting about for means to economize in harvesting. One of the ways developed towards that end has been to require that the woman who packs should increase her daily output from 80 9-pound baskets to 200. The woman fulfilled the requirements without working any harder in one case than the other. The increase is at the expense of quality of packing, which at first was at the expense of the consumer or shipper, but in the final outcome resulted in less demand for the Grapes. The public may be fooled part of the time, but sooner or later smart practices will come back to the point from which they started like a boomerang. Grapes designed for shipment are packed in climax baskets. The size prevailing in the Keuka district are "poneys,' having a gross weight of less than five pounds. In the Chautauqua district the 8-pound is the almost universal size. The reason for such distinct customs is due to the demands of the markets to which the Grapes are shipped. Shipments of the Keuka section go to the Atlantic cities, and those from Chautauqua go to the west.



972. The third movement.

In the Lake Keuka district of western New York there are a number of wine cellars involving large capital, two or three of which make excellent champagne. This industry began at Hammondsport in the sixties, and several varieties of Grapes were planted solely for wine purposes, but the quality of the fruit was not good for table use. In the Chautauqua district the wine industry has received little attention compared to that given in the Keuka district. There has been no opportunity for the blending of several juices, for the reason that the Concord is so nearly the universal variety planted. But another industry—that of bottling Grape juice as it comes from the press—has lately been established, and promises considerable development.

The methods of marketing Grapes are of great variety. During the season of 1893 and 1894 there was formed in the Lake Keuka district and adjacent lakes a coöperative marketing association composed of producers. This association was incorporated and officered by its own members, and represented over three-fourths of the production of that district. The plan was to maintain prices more evenly and to secure a better equalization of supply and of markets. This association was abandoned after two years' trial. The failure was not due to excessive cost in selling nor want of integrity of the officers, but to inability "to pull together," and a desire of each producer to be independent, hoping to do a little better for himself than the association could do for him.

The Chautauqua district has had two periods of coöperative shipments, and each of longer duration than that of the Keuka field. The first was for the seasons of 1892, 1893 and 1894. The plan was resumed again in 1897, and continued through the seasons of 1898 and 1899. For the season of 1897 the association represented about 85 per cent of the acreage of the district beginning at Silver Creek, N. Y., and continuing to Harbor Creek, Pa., comprising about 25,000 acres.

These associations, no doubt, serve a good purpose in giving a more even distribution of fruit in different markets. When there is no concert of action the market of a certain city may be poorly supplied to-day and an advance of prices follows, a state of affairs quickly known to all shippers, with a result that everyone, trying to benefit by such an advantage, will consign to that market, making an aggregate far beyond the demand; and a sharp decline of prices will follow. A union representing a high percentage of acreage can prevent such gluts, provided the over-supply or under-consumption is not such that all the available markets in the country are not glutted, a state of affairs that is liable to happen at mid-harvest, when double the number of cars is forced on the market.

The total shipments from the Chautauqua district for seven seasons have been as follows:

	No. of Cars
1893	3,100
1894	3,600
1895	3,200
1896	4,050
1897	6,000
1898	——
1899	7,000

A. B. Clothier, of Silver Creek, N. Y., gives the following as the expense of planting and developing an acre of Grapes:

Plowing and marking an acre of land	$3 00
Number of plants, 8 ft. x 9 ft., 605. Cost	12 10
Cost of planting	1 50
Number of cultivations first season, 7. Cost	7 00
Cost of cultivation second season	7 00
Number pounds of wire for 2 wire trellis, 600 lbs.; staples, 6 lbs. Cost	22 80
Number posts for trellis, 202; number braces, 20. Cost	14 14
Cost of putting up trellis	3 00
Cost of acre of Grapes, exclusive of land	$70 54

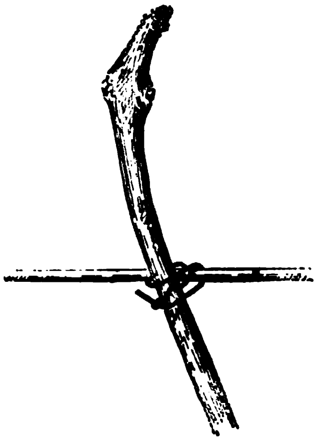
S. S. Crissey, of Fredonia, N. Y., horticultural editor of the "Grape Belt," without going into details, puts the total cost of an acre of vineyard at from $75 to $80, which practically agrees with that of Mr. Clothier. These are men of experience and wide observation, and their estimates may be considered to be representative and reliable.

Mr. Clothier gives the following estimate for the cost of labor for an acre of Grapes in bearing, per season:

Cost of pruning, pulling brush, tapping posts, righting braces, stretching wires, tying of vines, and cultivation per acre	$12 00
Cost of picking into crates, 4 tons of Grapes	4 50
Cost of hauling to station and loading in car, 4 tons of Grapes	4 00
	$20 50

Mr. Crissey's estimate is a little higher, making cost under the same conditions to be $23.

As to the yield of an acre of Grapes in the Chautauqua belt, the variation is great. A vineyardist who has any expectation of standing in line with progressive men should expect to have a record of 4 tons of Concords per acre. This is more than the average, but unless a man can exceed the average in any line, there is small chance for him to succeed.



973. The tie complete.

As to prices, the variation during the past seven years has been greater than that of the yield. Grapes have been sold at less than $10 per ton, and at more than $15. When more than the latter, it is risky for the seller to be too confident of a much higher price for any great length of time; and if less than the former, the buyer would better secure his supply as soon as possible. An average price is, say, $12.50. This gives a gross income for a 4-ton acre of Concords as $50, and a net income from $27 to $30. Be it remembered that this is for Grapes in crates. The cost of packing 4 tons of Grapes in 8-pound baskets, including baskets, would be from $28 to $30. The prices for Concords in crates or baskets vary so much that it may be advantageous to sell in either way. A man with a small vineyard and a large family would pack in baskets, when another who had to pay all his help or who found help scarce would sell by the ton in crates.

JOHN W. SPENCER.

Grapes in the South.—The region south of the 38th degree north latitude has in it more native species of Grapes than all the world besides. This alone would lead one to suppose the South naturally adapted to vineyard culture. Yet New York, Ohio and California up to the present far excel it in vineyard area, although only three or four species are native in these states. The cause of this is that diligent experimenters and originators have produced varieties of good marketable value adapted to those regions, from natives of those regions, or hybrids of natives with hardiest foreign kinds. In the case of California, the vinifera varieties are mostly grown because the climate and other conditions are so similar to those of the native region of the vinifera. But the South has chiefly planted the northern and foreign varieties which succeed but indifferently in most southern localities, and has neglected almost entirely its native varieties until quite recently. Now experimenters have shown that most excellent and very successful varieties of all colors and seasons can be and have been produced by selection and hybridization of some of the large, fine-fruited varieties.

While the foregoing predicts by actual existence in practical market vineyards in a number of localities in the South what is in store for the South as a whole, the present state of Grape culture in the South at large is a different affair. Information gathered from best sources throughout the South shows that Grape culture is a very small industry. It shows that the leading varieties cultivated in the northern sections of the South are Catawba, Concord, Delaware, Early Victor, Elvira, Ives, Moore Early, Moore Diamond, Niagara, Norton Virginia, Perkins, Worden, Wyoming. Favorable mention is made of America, Beacon, Brilliant, Campbell Early, Gold Coin, Green Mountain, Laussel, Ozark, Presly.

East of Texas and south of Tennessee, the following are chiefly planted: Brighton, Champion, Concord, Delaware, Diana, Diamond, Elvira, Goethe, Hartford, Herbemont, Ives, Missouri Reisling, Moore Early, Niagara, Norton Virginia [Cynthiana], Perkins, Worden. Of the Muscadine class for wine: Flowers, James, Mish, Scuppernong, Thomas. Favorable mention, of varieties testing, is made of Brilliant, Bertrand, Carman, Fern, Gold Coin, Jaeger, Laussel, Marguerite, Superb. In the southwestern section, west of the 96th meridian, are chiefly planted the Herbemont, Jacquez [Black Spanish, Lenoir], Niagara and Golden Chasselas, Malaga and some other vinifera varieties near the gulf coast and in western Texas under irrigation. By several who have had them under trial for several years favorable mention is made of Bertrand, Brilliant, Carman, Fern, Jaeger, Laussel, Marguerite, Muench, Neva, Perry, as furnishing successful table and wine Grapes for this region.

For Georgia, Professor Hugh N. Starnes gives me the following notes: "Leading varieties in order named: Ives, Concord, Niagara, Delaware, Moore Early, Goethe, Lindley, and for wine Norton Virginia, Scuppernong and Thomas.

"General distance 10 x 10; Delawares 8 x 8; Rotundifolias 30 ft. apart. Single stake spiral method of training chiefly used, and either spur renewal or cane renewal pruning employed, according to circumstances. Some growers employ trellises instead of single stakes, using either one or two wires and adopting the umbrella Kniffin or low wire arm spur Kniffin system of training, according to circumstances. See Bulletin No. 28, Georgia Experiment Station.

"Very little wine is now made in this state, and that is nearly all claret from Norton Virginia, Ives or Concord. In southern Georgia a poor article of Scuppernong wine is made, but it is not adapted to trained palates—too foxy. Delaware and Goethe blended are sometimes used to make a very good Rhine wine, and when properly handled sometimes produce an excellent article. Goethe must, reinforced with 20 per cent of California brandy, makes a good pale sherry; yet it is difficult to sell wine here profitably. When it can be sold at all, prices range from 50 cts. to $2 per gallon, according to the grade. Grape vinegar, while generally regarded as inferior to cider vinegar, will bring about 25 or 30 cts. at retail and 20 cts. wholesale, and at these figures is more profitable than wine.

"When sold fresh the Grapes are generally shipped in refrigerator cars in 10-pound baskets to different northern points. Later shipments take a southerly direction to Atlantic and Gulf seaports. Sometimes the regulation 6- or 9-carrier peach crates are used for shipping Grapes, but are not as satisfactory as the 10-pound separate baskets. Delawares are generally shipped in 5-pound baskets. Returns are uncertain. They vary from 1½ cts. per lb. to 5 cts., according to circumstances. Sometimes as high as 10 cts. is realized on very early and very late shipments or with choice Grapes, but this is seldom. Distilleries pay three-fourths of 1 cent per pound delivered, or gather and pay ½ cent per pound. If only 1 ton per acre of Grapes is the yield, the gross return (and also the net return) per acre would thus be from $10 to $15. This is more than cotton ordinarily nets. With two tons per acre of Grapes, which is not an enormous yield, the return would be $30 per acre delivered at the still. To those who have no scruples in regard to so disposing of their crop, this is probably the most profitable method. There are local stills in almost every county.

"There is not much encouragement now for Grape raising in Georgia, and vineyards are annually being destroyed by hundreds of acres. Some planting, however, is still going on in southern Georgia, in the "wire grass" country, where the industry is still found profitable by reason of the fact that the northern market may be entered ahead of competition, and also that insects and fungous pests have not yet put in an appearance in that region." See *Georgia*.

Planting, Training, etc.—The vines of the true southern Grapes, such as Herbemont and the Post-oak Grape hybrids, are planted 12 to 14 feet apart, in rows 9 ft. apart, while such northern varieties as are planted are set 8 feet apart in row. The Muscadines, such as Scuppernong, are mostly grown upon arbors about 7 feet high and rarely or never pruned, although trained on trellis, as are other Grapes, and, pruned early in fall, after leaf-fall, succeed excellently. The culture is mostly with the plow, turning first away and then to the rows, hoeing the space along the row not reached by the plow. The trellis mostly used is the 3-wire trellis: first wire at 18 to 24 inches from the ground, and the others successively 1 foot apart, above the first. The training is generally an indifferent attempt at the Kniffin system, and no system is generally carried out. Some pinch back the leading shoots once, few twice. Some use single posts and spur-prune. A few have made the Munson canopy trough trellis of 3 wires, and report most favorably of it.

Fungicides are used successfully by some. Others plant only such as Ives, Norton Virginia, Moore Early, Perkins, and some other varieties not subject to rot and mildew, so as to avoid spraying. They also avoid, thereby, having Grapes of the finer qualities, and get only the lowest prices. From such mostly come the report that Grape culture with them is unprofitable. So it should be, as such Grapes in the market have the effect to depress prices on all kinds of Grapes, as any grower knows. In the moister parts of the South, black rot, downy mildew and ripe Grape rot are very prevalent, but, excepting the ripe rot, are readily overcome by the Bordeaux mixture spray properly applied.

Few growers in the South use fertilizers in their vineyards. Some use barnyard manure, but the more intelligent use cotton seed or cotton-seed meal in connection with ground bone, kainit and soluble phosphates.

Marketing and Profits.—The crop is mostly marketed fresh in the local or near-by markets, as the ordinary freight and express rates will not permit profitable returns on the varieties mostly grown. But it has been demonstrated that fine Grapes that will carry well can easily be grown in the South, and, when handled in best manner in neat baskets, are quite profitable.

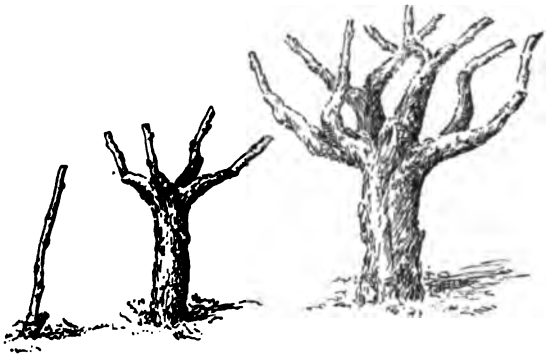
There are a few established wineries in the South, which use Ives, Norton Virginia, Herbemont, LeNoir, and some of the Scuppernong and other Muscadine varieties. The chief complaint of wine-growers is that legislation brought about by the prohibition movement is adverse and often entirely prohibitive. In consequence, some have bottled the juice fresh under some sterilizing process, but the people are not yet educated up to the use of this excellent, healthful, nourishing beverage, yet the demand for it is growing, and may be largely increased by enterprising makers.

Reports collected from all parts of the South state the profits all the way from nothing up to $150 per acre, sometimes higher, and it is clearly evident that the intelligence and enterprise of the planter is the chief element in controlling profits. Of course, localities, soils and varieties play important parts, but an intelligent grower would not select poor locality, situation, soil and varieties to start with, just as he would not pursue poor methods in the conduct of the business. As an illustration, the writer knows persons who bring to the Denison [Tex.] market, a place of 20,000 population, Ives and Perkins Grapes in bushel baskets, getting, by hard work, about one cent a pound, while others bring in neat 8-pound baskets, carefully packed, Delaware, Brilliant, Diamond, Niagara, Rommel and others of like good qualities, and get from 30 to 50 cents per basket the season through, with brisk sales and no grumbling.

It may be said, in conclusion, that the South promises everything to the wide-awake, intelligent Grape-grower, for its capabilities are unlimited in the production in quality and season when no other section competes with it, and it has vast markets at home and in the great cities just north of it. T. V. Munson.

Grapes on the Pacific Slope.—The Grape industries of California are established upon the success of the vinifera species. There are two wild species in the state, *Vitis Californica* and *V. Arizonica*, but by a popular error the term California Grape has been often used to indicate the Mission Grape, which was introduced from their earlier establishments in Lower California by the padres, who entered the territory now comprised in the state of California in 1769, to extend their missionary work among the aborigines. This Mission Grape has never been fully identified with any variety now grown in Europe, and whether the padres brought it to America in the form of seeds or cuttings is not known. The difficulty in identifying it has led many to consider it a seedling, but it is just as reasonable to hold that it was, two hundred years ago, an esteemed variety which was displaced in the course of viticultural progress by better varieties, and its survival at the California Missions is due to its isolation from that progress. It was this Grape which was found in California by the early American settlers, and very large areas of it were planted, but for the last thirty years it has decreased in favor rapidly, being displaced by many other varieties of superior value for various purposes. These varieties are almost wholly of the vinifera species. The native American varieties and their improved offspring thrive in California when given suitable situation and culture, but they do not meet any encouraging market demand. A very few packages glut the San Francisco market for their kind, while the vinifera table varieties are selling in large quantities. Only a few individuals give any consideration to American varieties for wine, and none of them are suited for raisins. The only attention given to the American species is in the use of some of them as phylloxera-resistant roots, upon which to graft the vinifera varieties, as is done in France; and California experience is a close reproduction of French results in this circumvention of the insect. It seems probable, although some districts are still free from invasion, that in the end all our vinifera vineyards will be upon American roots.

Grape-growing upon a large scale began in California very soon after the American occupation. In the fifties, collections of the leading European varieties were introduced, and state aid was secured for the promotion of viticulture. The first raisins were shown in 1863, and a considerable wine product was attained soon after, but the sale of it was attended by many disappointments, and discouragement ensued. In the latter seventies the wine interest was revived by better demand for the product, and a new propaganda for extension on better lines and with more suitable methods and better varieties, was earnestly taken up. Again the state granted funds liberally, and the agitation resulted in vine planting and cellar construction in the valleys and foothills all over the state. The product increased more rapidly than the demand for it, and the quality of much of it was successfully impeached. Losses and disappointments were again encountered, and the area of wine Grapes was largely reduced by abandonment, by the advancement of the phylloxera and by the inroads of a peculiar disease which has baffled effort to determine its cause, though thousands of acres have been swept away by it. Even the lessened wine product found most acute trade issues to meet, which were temporarily overcome by growers' coöperative effort until the constantly shrinking production met an advancing demand, and profitable prices for wine Grapes were again secured. This fact has again stimulated interest in planting, even with the greater investment required by resistant roots, and the century closes with a renewal of confidence which bids fair to again extend the wine industry of the state.



974. The common short-pruning system used for the Vinifera Grape in California.

The raisin interest of the state did not attract wide attention until about 1875, but it advanced with great rapidity until 1894, when a product of 103 million pounds was reached and a decline of value below the cost of production ensued. As events have proved, this decline was largely due to lack of proper system in marketing, for a period of loss and depression has been followed by return to prices yielding a profit through control of the marketing by a coöperative association of the growers. This experience came just in time to save the raisin interest from large sacrifices, and points the way to future maintenance. The shipping of table Grapes from California to the markets of the eastern states has reached an aggregate of about a thousand car loads on several different years, and is one of the fixed features of overland fruit shipment. The area of Grapes in California in 1900 is about 140,000 acres: one-seventh table Grapes, two-sevenths raisin Grapes and four-sevenths wine Grapes, as nearly as can be estimated.

The Grape has a wider range of adaptation in California than any other single fruit. It endures all elevations to which commercial fruit-growing is carried; it thrives in the most intense valley heat if amply supplied with water by irrigation. It accepts all fertile soils, but is most profitable upon light, deep, warm loams, both in the valleys and on the hillsides. All varieties which will bear well with such treatment are grown with low stumps and very short pruning, which discards nearly all of the previous season's growth. Only a few varieties are given longer canes and the support of a wire or a high stake.

The training of the vinifera Grape is very unlike that of the native Grapes. The stocks are kept to low, strong stumps, and the bearing shoots are not trained or are tied to stakes. Trellises are not used. Fig. 974 shows 3 epochs in the common style of pruning, the right-hand figure representing the mature vine.

Though hundreds of varieties of vinifera have been introduced from Europe and Asia during the last half century, only a few have survived cultural and commercial tests and are now planted. For raisins the prevailing varieties are White Muscat of Alexandria, and the Muscatel Gordo Blanco and the Malaga, with the Sultana and Thompson Seedless for seedless raisins: for table Grapes, in addition to the foregoing, the Flame Tokay, Emperor, Cornichon, Black Malvoise, Rose of Peru. Black Hamburg, Chasselas varieties and Verdal are chiefly grown, though, of course, a much larger list prevails for local uses. In wine Grapes there is naturally a larger list to meet local requirements of soil and climate and to produce the various kinds of wine.

Acceptable varieties for dry wines are:

Red (*Claret and Burgundy*).—Zinfandel, Carignan, Mataro, Mourastel, Petite Sirah, Petit Bouschet, Alicante Bouschet, Grenache, Valdepeñas, Cabernet Sauvignon, St. Macaire, Beclan, Mondeuse, Blue Elbling, Refosco, and Barbera.

White (*Sauterne*, *Hock*, etc.).—Semillon, Sauvignon Blanc and Vert, Johannisburg Riesling, Franken Riesling, Traminer, Chasselas Dore (Gutedel), Chauche Gris, Burger, Folle Blanche, Feher Szagos, Green Hungarian, Palomino, White Pinot, Thompson Seedless.

Varieties for sweet wines are:

Ports.—Mission, Malvoisie, Grenache, Trousseau.

Sherry and Madeira.—Mission, Palomino, West White Prolific, Verdelho, Feher Szagos, Sultana, Thompson Seedless.

Angelica, *Muscat*, etc.—Muscat of Alexandria, Muscatella, Furmint (Tokay wine).

In regions of the Pacific coast north of California, vinifera varieties are less widely grown, and locations meeting their requirements must be selected with much care and circumspection. The number of varieties is much smaller than in California, as there is no product of wine or raisins, but of table Grapes only, and they are almost wholly early ripening kinds, which can mature in the shorter growing season at the North. On the other hand, the American varieties are widely grown, the Concord, Delaware, Moore Diamond, Moore Early, Niagara and Worden being most favorably reported.

E. J. Wickson.

Grapes Under Glass.—Under glass, the European varieties alone are used. This species, *Vitis vinifera*, is the vine of the ancients, and is indigenous to the more salubrious parts of eastern Asia and southern Europe. It is referred to in the earliest mythological writings of ancient Egypt and thence on numberless occasions, notably in the Bible and the New Testament. The story of the spies from the promised land, with its generous illustration, has excited the admiration and perhaps questioned the credulity of many of us. It is only fair, however, to state that the size of the cluster there represented has been amply borne out in recent years. The type *Vitis vinifera*, if there ever was a type, has become so merged and modified by cultivation in different climates and countries that it is difficult to trace it at the present day. Over 2,000 varieties have been described, covering the widest range in size, color, texture and flavor, general appearance and quality.

For disparity of size, we have the diminutive Black Corinth, from which the Zante currants are prepared, and the giant Gros Colman, now extensively grown for commercial purposes under glass in England; and for contrast in color we have the beautiful Rose Chasselas and the pink and white Frontignans and Muscats, with their superb qualities and flavors, growing by the side of the blue-black Alicante of thick skin and coarser texture, but valuable for its late-keeping quality; and worth more than all the others put together, we have the Black Hamburg, combining all the good qualities, and easy of culture.

Probably in no branch of horticulture is the gardeners' skill more generously rewarded than in Grape-growing under glass. In England it has been an essential feature of horticultural work for more than a century, resulting in fruit of a finer quality and flavor than that grown in the open air, and very often enormous clusters, weighing from 20 to 30 pounds. Started there as a matter of luxury, it has become of late years a matter of profit, and vineries of large extent have been erected for commercial purposes. Probably this work has been retarded here by the introduction of the many very excellent varieties of our native Grapes, so easily grown in the open air and so constantly improved by hybridizing with the European, and undoubtedly this work will yet result in a much closer approach to the standard of European quality.

The essential difference between American and European kinds is that in the American the pulp separates from the skin, is usually tough and more or less acid, so that it is disagreeable to remove the seeds, while in the European the pulp adheres to the skin, is tender and sweet throughout, and the seeds are easily removed. European Grapes, when well grown, are valuable and agreeable for the use of invalids, and, undoubtedly, in the judgment of the majority of people, surpass in quality any other fruit grown.

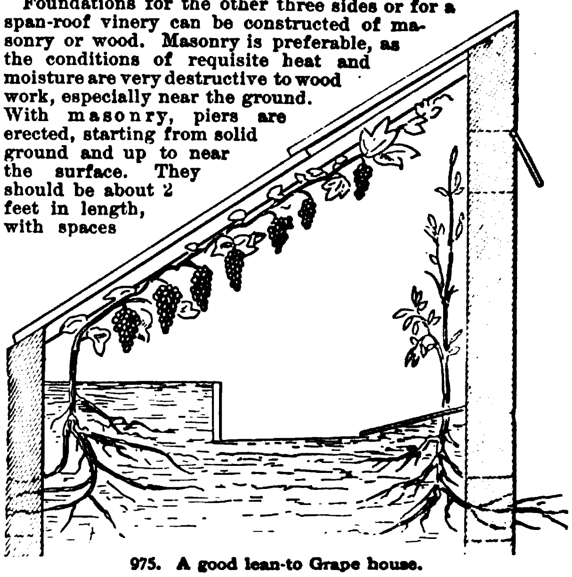
The subject of Grape cultivation under glass may be divided under several heads, as follows: *The Houses; The Border; The Vines; The Fruit.*

The Houses.—These are mainly of two forms, span-roof and lean-to, with occasional modifications between. Unless one has ample time and a desire to study their construction, it is better to have plans and estimates furnished by professional builders.

Span-roof houses are adapted to large places with spacious grounds, and particularly when an ornamental effect is desired. On account of their exposure on all sides, they require very careful attention, especially if used for early forcing of Grapes. Where early work is not desired, or for use without artificial heat, their disadvantage is not so apparent. Houses without artificial heat, known as cold graperies, were in earlier years in more general use than those with heat, but have about disappeared with the introduction of the modern economical heating apparatus, and the very great advantage in the use of the same, if only to a limited extent.

Lean-to houses, on account of their snug construction and protection from northerly or prevailing winds, are especially desirable for early forcing of Grapes (Figs. 975, 976). Often a stable or other building can be utilized for the north side, but generally a wall of brick or stone is erected for this purpose. Such a wall can be covered on the outside with *Ampelopsis tricuspidata*, or Crimson Rambler roses, producing a beautiful and ornamental effect. A good house, on a small scale, can be made of hotbed sash (Fig. 976).

Foundations for the other three sides or for a span-roof vinery can be constructed of masonry or wood. Masonry is preferable, as the conditions of requisite heat and moisture are very destructive to wood work, especially near the ground. With masonry, piers are erected, starting from solid ground and up to near the surface. They should be about 2 feet in length, with spaces



975. A good lean-to Grape house.
The roots run through the wall to an outside border.

of 2 feet between, and opposite each space a vine is to be planted inside the house, as hereafter described. Strong capstones, thick enough to come slightly above the surface of the border and about 18 inches wide, are then laid from pier to pier. On such a foundation a superstructure can be erected with some confidence. For the base of the superstructure masonry is preferable, about 18 inches in height being necessary before the glass work begins. A hollow wall, constructed of hard brick and cement, is desirable, and openings should be left for ventilation. The upper surface of these walls should be covered with cement. If constructed of wood, the same general plan should be carried out, using the most durable kind only.

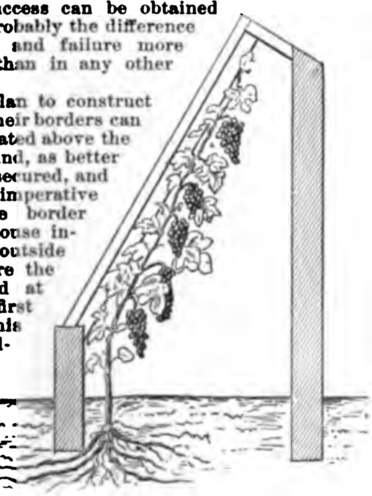
Aside from its durability, masonry has an advantage over wood in being a better equalizer of temperature, and the heavy back wall of a lean-to house can be made of great value for this purpose. The general plans of the superstructure are shown in the illustrations. It should present as much glass surface as possible. The frame can be of iron or wood, as preferred. Light, heat and moisture are the great features desired, also a generous supply of air under favorable conditions. The glass should be of good quality, otherwise blisters will burn the foliage and fruit. Small ventilators covered with wire gauze should be built in the foundation walls, and large ones at the upper part of the house. Ventilation should always be free from a draft or sudden change of temperature. A draft is just as unpleasant to a sensitive vine in a house as it is to a human being, and if subjected to it disease is sure to follow, mildew being the first evidence; and yet a generous supply of air is a prime requisite in growing Grapes under glass, especially during the ripening period. Previous to that time the lower ventilators should be very carefully used, some growers never opening them until the Grapes begin to color, and the new growth and foliage are somewhat hardened. More or less air is always admitted around the glass in a very equable manner and thence to the upper ventilators.

The modern heating apparatus, consisting of a boiler in an adjacent pit for heating water, with circulating pipes throughout the house, as shown in illustrations on *Greenhouse*, is a very perfect and economical supplier of heat, and it should be erected by a practical builder. A little heat at a critical time will often save a house full of Grapes, and, while it can be dispensed with, its advantages are very material.

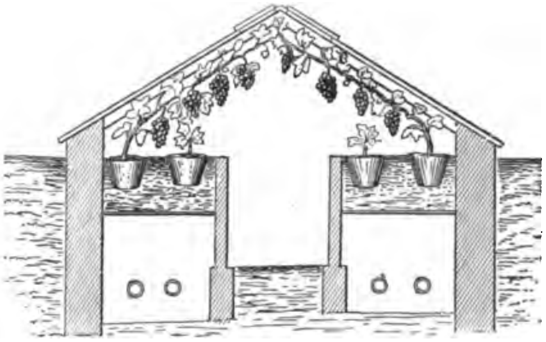
It is possible to fruit Grapes in benches in pots, removing the pots when the fruit is past, and using the house for other purposes (Fig. 977).

The Border.—A good border is of great importance, as no permanent success can be obtained without it, and probably the difference between success and failure more often lies here than in any other feature.

It is a good plan to construct vineries so that their borders can be somewhat elevated above the surrounding ground, as better drainage is thus secured, and good drainage is imperative (Fig. 975). The border should fill the house inside and extend outside adjacent to where the vines are planted at least 6 feet when first made, and to this outside border additions should be made every two or three years of from 2 to 4 feet until a width of 20 feet is secured. The border can hardly be made too rich, provided the material is well decomposed. A mixture of six parts good loamy turf from an old pasture or piece of new ground, and one part of well prepared manure, one part old plaster or mortar, and one part of ground bone, all to be well composted together, will meet all the requirements. If the subsoil is clay, a foundation of old brick and mortar is very desirable to insure drainage. The border above this should be from 2 to 3 feet in depth. No trees or shrubs should be permitted to extend their roots into it, a very common cause of trouble, and nothing whatever should be grown on it, although the temptation to try a few melons or some lettuce is often too great to be overcome, and these probably do a minimum of damage. In such a border, if properly supplied with water, the vine roots will remain at home, and not go wandering off into trouble. Where extra early work is not desired, no attempt should be made to keep the frost entirely out of the border during the winter, as this is apt to result in a heavy, sodden surface in spring. It is better to spade it up roughly just before winter and cover with a good coat of manure, permitting the frost to enter the ground some inches. In the spring it is dug over again and, when raked off, presents a rich, lively surface. The inside border is to be covered with a coat of well-rotted manure, and spaded up and well watered at the time of starting the vines. For midseason work, from February 15 to March 1 is the proper time to do this in New York state, the inside border carrying the vines nicely until the outside border is in shape a month or more later. Then without hard forcing early Grapes can be brought in by the last of June or July, and the later ones through the following two or three months. It is much better to store late Grapes in modern Grape rooms, where they can be kept fresh and plump for several months through the winter, than to attempt extra early work by starting vines in heated borders in November and December.



976. Lean-to grapery glazed with sash.

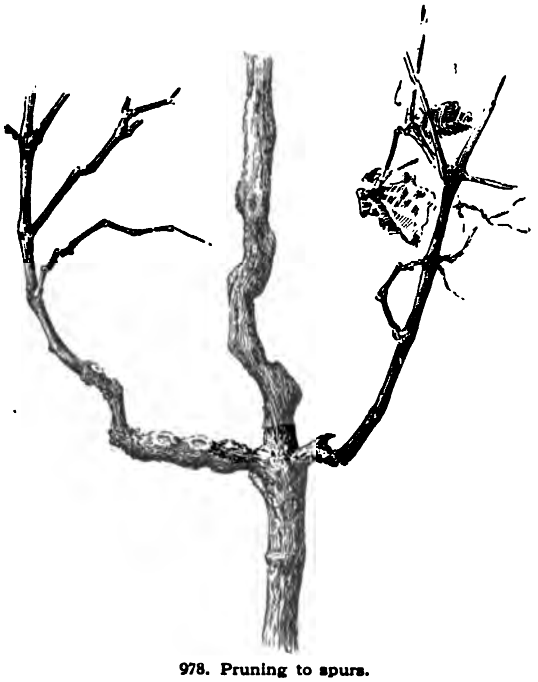


977. Even-span house, with the vines plunged in pots.

The Vines.—The amateur should purchase these from some nurseryman of established reputation. Vines 1 or 2 years old are better than older ones. For supporting the vines, light cast-iron brackets are secured to the rafters, and these support wires running lengthwise of the house about 15 inches from the glass, and to these wires the vines are tied as fast as they grow. The vines are to be planted inside the house about a foot from the front wall and about 4 feet apart, placing one opposite each opening in the foundation as before described. It is not desirable to plant them along the back wall of a lean-to house. They should be cut back to two or three buds near the ground, and when these start the strongest shoot only is selected for training and the others rubbed off. As this shoot advances it is tied to the wires, and it may reach the limit of the house by July 1, or perhaps not until September 1, depending on the care, the vigor of the vine, and the border. Once there, the end is pinched and the cane continues to strengthen and increase in size and store up material in the lateral buds until the end of the season, when it is taken down and pruned to one-third its length, laid on the ground and covered from the sun for the winter. Care should be taken that mice do not eat out the buds, as once out they can never be restored. In the spring of the second year, or as soon as it is desired to start the vines, they are tied up again, and the terminal shoot again trained to the top of the house, where it is stopped as before.

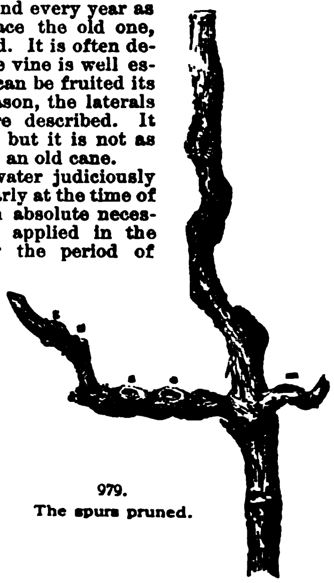
Any fruit appearing on this shoot should be removed. The lateral shoots that start out each way below the terminal should be thinned to about 12 or 15 inches apart on each side. This is an important feature, especially if we adopt the spur system of pruning, which we will first consider, for we are now establishing our vine for a long term of years, and it is desirable to have it symmetrical with the side shoots, and fruit evenly distributed over its entire length. An example of a well balanced vine is given in the illustration of the Muscat Hamburg. A few clusters of fruit may be taken from this part of the vine this second year, and the laterals should be pinched at two eyes beyond the cluster, and as they break pinched again through the season. As soon as the leaves fall, the vines are again taken down for pruning. The terminal should be shortened about one-half and the side shoots cut back to a bud very close to the main stem, when it goes through the winter as before.

At the beginning of the third year the terminal again goes to the top of the house without fruit, when it is stopped and the laterals are allowed to bear as before, say not more than one pound of fruit per foot of the main stem. We now have our vine established to the top of the house, and the only pruning in after years is to cut the laterals each year close to the main stem. A bud will nearly always be found in the first one-eighth inch, sometimes several of them. When these start, the strongest is selected and the others rubbed off, unless one is desired for training to the opposite side to fill a vacancy there. When the vines attain full strength, two pounds of fruit per foot of main stem can be grown, but heavy loads require great care. Too heavy a load causes shanking, and then all is lost. The stems of the berries wither and the fruit turns sour before ripening. Rigid pinching of the laterals is very important. Commence at the second joint beyond the cluster, or about 18 inches from the main stem, and pinch thereafter as fast as new shoots break and show a leaf. Pinch early and often. It has been said that a good gardener can carry the summer prunings from a large vinery for an entire season in his vest pocket. Some require a wheelbarrow. At the place where the laterals start, a spur soon forms on the main stem, from which the system takes its name. It often becomes several inches in length and quite ungainly. This spur system of pruning is represented in Figs. 978–980.



978. Pruning to spurs.
A long or old spur is shown on the left.

In the other system of pruning, known as the "long rod" or "long cane" system, a new cane is grown up from a bud near the ground every year as often as desired to replace the old one, which is entirely removed. It is often desirable to do this. If the vine is well established, this new cane can be fruited its entire length the first season, the laterals being pinched, as before described. It will produce finer fruit, but it is not as safe with a heavy load as an old cane.



979.
The spurs pruned.

An ample supply of water judiciously and freely used, particularly at the time of starting the vines, is an absolute necessity. It should not be applied in the house, however, during the period of blossoming, as a dry air is advantageous for the transfer of the pollen for fertilization.

An important feature is thinning the clusters and establishing the load a vine has to carry. This requires experience and judgment. As a rule, about one-half the clusters should be removed —often more—care being taken to balance the load evenly on each side. This should be done as early as the general form of the clusters can be seen, except with the Muscats and other shy setting kinds, when it may be well to wait for the berries to set, as some clusters set perfectly while others fail.

Thinning the berries should be attended to promptly, selecting cool days and mornings for this work. Close growing kinds, like Alicante, cannot be commenced on too early after setting, and it is much better to crowd this work than to have it crowd the operator. In many varieties one-third to one-half the berries have to be removed. Experience is the only guide in this. A pointed stick is very useful with the vine scissors, and never touch the clusters with the fingers.

Tying up the shoulders of the clusters is necessary to permit a free circulation of air and light, otherwise the interior may decay, and, once started, the cluster is soon gone. The principal diseases or troubles to guard against are mildew and red spider. The remedy for the former is sulfur, and for the latter moisture. Mildew is generally brought on by a sudden change of temperature. A vigorous condition of the vine has much to do in resisting it. Red spider will almost always appear in the hot weather of July and August if the vines are allowed to become too dry.

Thrips are sometimes very injurious, but can be controlled with nicotine, which, if properly applied, will not injure the fruit. Thrips and red spider, if not taken in time, multiply rapidly, and "an ounce of prevention is worth a pound of cure" in these cases.

Perhaps, in a general way, the most important requisite of all is a large amount of enthusiasm and love for the work. This is necessary to insure the continued care and culture requisite to permanent success.

The Fruit Varieties.—As said before, very many varieties exist, but probably not one-half of these are in active cultivation at the present time. Varieties are adapted to localities, soils, climates, etc. Perhaps 50 have been grown under glass in this country. Of these we will consider a few of the more prominent.

The Black Hamburg is more extensively grown and of more value for this purpose than all others put together, because it meets the requirements of the ordinary cultivator, and will stand abuse and neglect and still give fair results better than any other kind. It rarely gives very large clusters, but is a free bearer, sets perfectly, will carry heavy loads and matures early. Under better care the appearance and improvement in quality is remarkable, and it can be made as good as the best. It is the variety with which the novice begins. Many houses consist entirely of Black Hamburgs, and many that do not would give far better satisfaction if they did.

Muscat of Alexandria is the best of the white varieties for general cultivation. It requires a higher temperature and longer season than the Black Hamburg to come to perfection, and will keep longer after cutting than that kind. When well grown and ripened it may be taken as a standard of quality. See Fig. 980.

Muscat Hamburg is a black Grape, probably a cross between the two above named varieties, and presenting marked characteristics of each. It has beautiful tapering clusters of fine quality.

Barbarossa is a good variety for those ambitious to grow large clusters, and when well grown is of fine quality. It is a late black Grape, requiring a long season to ripen well, but repays for the trouble by keeping thereafter for a long time. Clusters frequently grow to 8 or 10 pounds in weight, measuring about 24 inches each way, and they have been grown to more than double this weight.

Other large-growing varieties are the **White Nice** and **Syrian**, the latter of which is said to be the kind that the spies found in the land of promise. Clusters of 20 to 30 pounds weight are common to these two coarse-growing kinds, but their quality is so poor that they are now rarely grown.

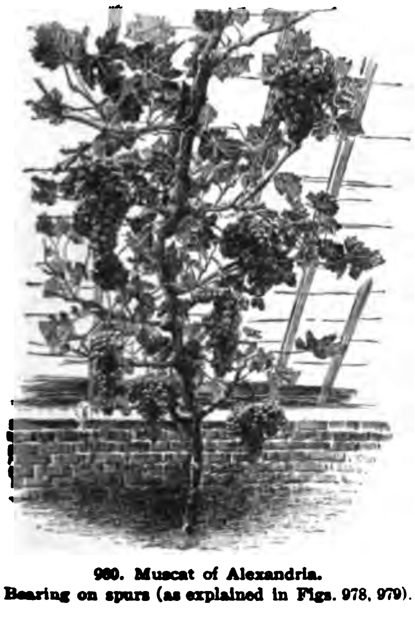
Grizzly Frontignan is a beautifully mottled pink Grape —quite a deep pink sometimes—and has long, slender clusters. In quality and flavor it is unsurpassed by any other Grape, and it ripens rather early.

Royal Muscadine is an early white Grape of fair quality and good habit; frequent in English houses.

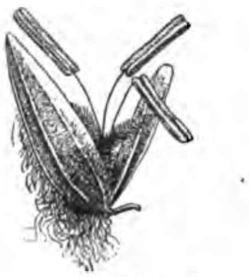
Gros Colman, a large black Grape of fine quality and a late keeper, is now grown largely for commercial purposes in England and sent to this side to supply our wants in this line in spring. The berries frequently measure 4½ inches around, and it therefore requires early and severe thinning.

Alicante is a black Grape of very distinct character, seeming to depart somewhat from the vinifera type, very juicy, and of fair quality. It has a very thick skin, and is about the best for long keeping.

Lady Downs is another late black Grape of good quality, but not adapted to all localities. **Rose Chasselas**, a small red Grape, is the earliest and very beautiful. **Trentham Black**, the earliest black Grape, has small clusters, but large, soft berries quite like Alicante. **Foster Seedling** is a beautiful midseason, amber-colored Grape, with large clusters and berries sometimes liable to crack. **Madresfield Court Muscat** is a midseason Grape—fine in quality, but also inclined to crack. This trouble can often be controlled by twisting or slitting the stems of the clusters, thereby checking the flow of sap.

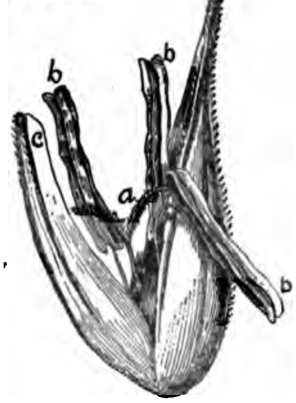


980. Muscat of Alexandria.
Bearing on spurs (as explained in Figs. 978, 979).



981. Floret of June-grass.
Showing the floral glume, palet, two feathery stigmas, and three stamens. Enlarged.

(See *Grass*, p. 682.)



982. Floret of a Grass (rye). Much enlarged.
cc, floral glume and palet; *a*, stigmas; *bbb*, stamens.

Many other popular varieties are described in various works devoted to Grape culture.

For other notes on Grapes under glass, see the article on *Forcing*. D. M. DUNNING.

GRAPE-FRUIT. See *Citrus Decumana* and *Pomelo*.

GRAPE HYACINTH. *Muscari botryoides*.

GRAPE, SEASIDE. *Coccoloba uvifera*.

GRAPTOPHÝLLUM (Greek words referring to the variegated foliage). *Acanthàceæ*. An oriental genus of about 5 species of tender shrubs, one of which is cult. in a very few American conservatories for its variegated foliage, and is said to be very popular in India and through the tropics. No two lvs. are marked exactly alike, but the yellow color is near the midrib rather than at the margins. The genus is close to Thyrsacanthus, but in Thyrsacanthus the fls. are not so distinctly 2-lipped. Lvs. opposite, entire (in one species spiny-dentate), often colored: fls. reddish purple, wide gaping, clustered either in a terminal thyrse or in the axils; corolla tube inflated above; upper lip with 2 short recurved lobes; lower lip 3-cut; stamens 2. For culture, see *Justicia*.

horténse, Nees (*G. pictum*, Griff. *Justicia picta*, Linn.). CARICATURE PLANT. Height finally 6–8 ft.: lvs.

elliptic, acuminate, irregularly marked with yellow along the midrib: fls. crimson, in axillary whorls; corolla pubescent. Habitat? B.R. 15:1227. Lowe 45. (B.M. 1870 shows a variety with reddish brown coloring).

GRASS (*Gramineæ*). Annual or perennial herbs (some bamboos woody), mostly tufted or decumbent, rarely climbing, often creeping and rooting at the base. True roots fibrous. Stems (culms) simple or branching, usually hollow (wheat), sometimes solid (maize) between the nodes. Leaves springing from the nodes, alternate, in two vertical rows on the stem; the sheaths closed when young, but usually split down one side in maturing; ligule a thin tongue-like growth at the apex of the sheath; blade entire, parallel-veined, commonly long and narrow; a 2-keeled membranous prophyllum (or leaf) always standing between each branch and the main axis. Spikelets in panicles, racemes or spikes, usually consisting of 2 (rarely 0, 1, or more than 2) chaffy empty glumes at the base of a short axis (rachilla), which supports one or more floral glumes, in the axil of each of which is commonly 1 flower. Flowers perfect or imperfect, destitute of true calyx or corolla. Between each floral glume and flower are usually 2 (rarely 3) minute hyaline scales (lodicules). Stamens 3 (rarely 1, 2 or more than 3); pistil 1: ovary 1-celled, 1-ovuled; styles 2 (rarely 1 or 3), usually plumose: fruit (grain or caryopsis) seed-like, often enclosed by the palet and its floral glume. Seed erect, closely covered by the thin pericarp; embryo small, on one side of the base of the endosperm. Figs. 981–984 show the structure of various Grass florets.

983. Spike of a Grass (rye), containing many flowers.

Perennial Grasses, such as those commonly grown for meadow, pasture or lawn, produce large numbers of sterile shoots that bear leaves from very short stems, but no flowers. There are many widely different plants, which in popular language have the name "grass" attached to them, such as knot-grass, rib-grass, cotton-grass, sea-grass, eel-grass, sedge-grass, scorpion-grass, but these do not belong to the family here under consideration. Neither are the clovers and their allies, or the sedges and rushes, to be called Grasses. No other plants are truly entitled to this name, excepting those answering to the description above given.

The plants most likely to be mistaken for Grasses are the sedges (Cyperaceæ), of which there are large numbers in great variety frequently found on wet land. The best popular way to distinguish Grasses from sedges is this: the leaves of sedges are arranged on 3 sides or angles of the stem, while on Grasses they are found on 2 sides, alternate and 2-ranked. In making use of this test, care must be taken to select well grown, erect stems. Most sedges have solid stems and most Grasses have hollow stems. To learn to distinguish plants of the Grass family is easy, but to discriminate between species is difficult.

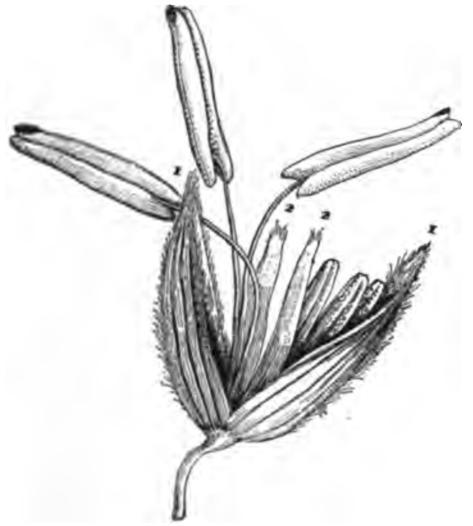
Among the species most commonly known are timothy, red top, June-grass, orchard-grass, meadow foxtail, the fescues, oat-grass, sweet-vernal, quack-grass, Bermuda-grass, sugar cane, chess, and the cereals, such as wheat, barley, rye, oats, rice, sorghum, Indian corn. In number of species the Grass family occupies the fifth place with 3,500, while the compositæ, legumes, orchids and madderworts are larger. In number of individuals, the Grasses excel any other family. Seed plants are arranged in 200 to 220 families, and of all these the true Grasses are of greatest importance to man; in fact, they are of more value as food for man and domestic animals than all other kinds of vegetation combined. None of these families is more widely distributed over the earth's surface, or is found in greater extremes of climate or diversity of soil.

The species are very numerous in tropical regions, where the plants are usually scattered, while in a moist, temperate climate, though the species are less numerous, the number of plants is enormous, often clothing vast areas. Where soil is thin or moisture insufficient, the Grasses grow in bunches more or less isolated. Plants of one section of the family Panicaceæ predominate in the tropics and warm temperate regions, while plants of the other section, Poaceæ, predominate in temperate and cold regions.

Overstocking dry grazing districts checks the better Grasses, destroying many of them, and encourages the bitter weeds which multiply and occupy the land.

A Grass extends its domain by running rootstocks, by liberating seeds enclosed in the glumes, which are caught by the breeze, by some passing animal, or the nearest stream; the twisting and untwisting of awns bury some of them in cracks, crevices or soft earth. In case a growing stem is thrown down for any reason, several of the lower nodes promptly elongate on the lower side and thus bring the top into an erect position. Each sheath supports and holds erect the tender lower portion of the internode, where it is soft and weak; it also protects the young branches or panicles. Thrifty blades of Grasses suitable for pasture and lawn elongate from the lower end, so that when the tips are cut off the leaves do not cease to elongate, but renew their length. When exposed to sun or dry air, the blades develop a thicker epidermis, and, by shrinking of some of the delicate bulliform cells of the upper epidermis, they diminish their surface as they roll their edges inward or bring them together, like closing an open book. When the plant is in flower the minute and delicate lodicules become distended just in time to spread the glumes and liberate the stamens.

Grasses are not so much employed for ornamenting homes as their merits warrant. By selecting, some can be found suited to every week of the growing season, though many of them are in their prime during June, the month of roses. Wild rice (Zizania) is fine for rich soil in the margins of ponds, and masses of reed grass for deep beds of moist muck. For massing or for borders the following and others are stately: *Arundo Donax*, *A. conspicua*, maize, pampas grass, Eulalia, ribbon grass, *Andropogon formosus*, *A. Halepensis*, *Asperella Hystrix*, Tripsacum. For glaucous blue-green, use *Elymus arenarius*, *Festuca glauca* and *Poa cæsia*. For potting and borders, there are striped varieties of Dactylis, Anthoxanthum, Alopecurus, *Holcus lanatus*, *H. mollis*, *Poa trivialis*, *Phleum pratense;* and others may soon be produced. For table decoration nothing is better than the elegant, airy panicles of large numbers of wild Grasses, such as species of Poa, Kœleria, Eatonia, Panicum, Paspalum, Eragrostis, Muhlenbergia, Bromus, Festuca, Agrostis, Deschampsia, Uniola, Briza, *Cinna pendula*. For large halls and exhibitions, what surpasses sheaves of wheat, barley, rice, oats or any of the wild Grasses ? For decoration, Grasses should be cut before ripe, dried in the dark in an upright position, and may be used in that condition or dyed or bleached. For paths, nothing is more pleasing than strips of well mown lawn.



984. Staminate spikelet of a Grass (maize).
Showing two florets, one of which (with three stamens) is expanded. 1, 1, empty glumes; 2, 2, palets. Enlarged.

Drainage keeps out sedges and encourages the better Grasses; manure and irrigation help the best Grasses to choke and diminish most weeds. Enough has already been done to show that rich rewards are sure for him who patiently and intelligently attempts to improve Grasses for any purpose whatever by selection and crossing. Quack-grass is excellent for holding embankments; *Ammophila arenaria* for holding drifting sands. The Grass family furnishes its full quota of weeds, among them quack-grass, crab-grass, chess, June-grass, sand-bur, stink-grass.

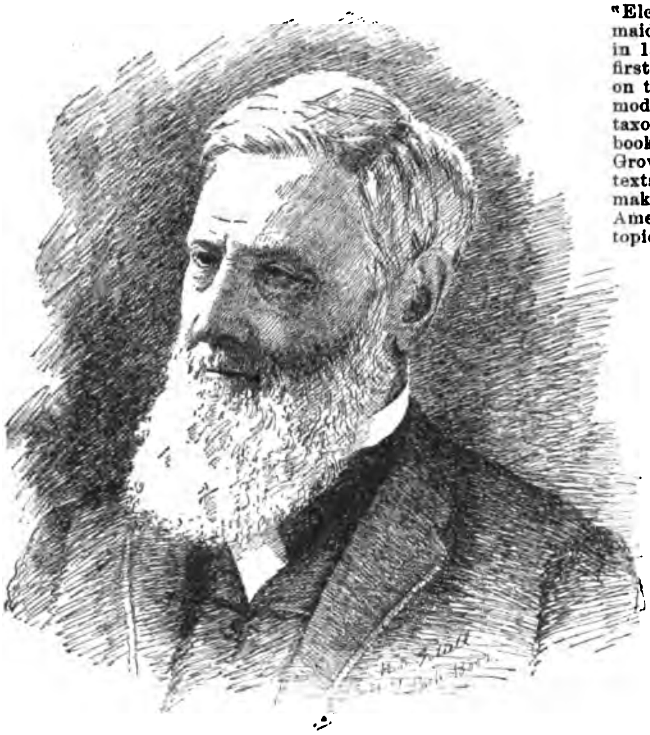
Turf-forming Grasses are those that spread freely by creeping rootstocks, such as June-grass, quack-grass, Bermuda-grass, Rhode Island bent and red-top, while most others are more or less bunchy. For northern regions not subject to severe droughts, sow Rhode Island bent and June-grass both, or either one alone; for northern regions, which are liable to suffer from dry weather, sow June-grass and plant Bermuda-grass. These two on the same ground supplement each other in different kinds of weather, securing a green carpet during every part of each growing season. W. J. BEAL.

GRASSES, POPULAR NAMES OF. There are few Grasses which hold commanding positions as specimen plants, although the agricultural values of Grasses are transcendent. Some of the commoner vernacular Grass names are given below, with references to the proper genera: **Animated Oats,** *Avena*. **Artificial G.,** sometimes used for certain forage plants, as sorghum, but also leguminous plants, as clover, lucerne, sainfoin. **Awnless Brome G.,** *Bromus inermis*. **Beach G.,** *Ammophila arenaria*. **Bear G.,** unusual name for *Yucca filamentosa*. **Beard G.,** *Andropogon;* also *Polypogon Monspeliensis*. **Bengal G.,** *Setaria Italica*. **Bent G.,** *Agrostis*. **Bermuda G.,** *Capriola Dactylon*. **Blue-eyed G.,** *Sisyrinchium*. **Blue G.,** *Poa*. **Blue Joint G.,** *Calamagrostis Canadensis*. **Bog G.,** *Carex*. **Bristly Foxtail G.,** *Setaria magna*. **Brome G.,** *Bromus*. **Buffalo G.,** *Buchloë dactyloides*. **Canada Blue G.,** *Poa compressa*. **Canary G.,** *Phalaris Canariensis*. **Cat-tail G.,** *Phleum pratense*. **China G.,** *Bœhmeria nivea*. **Citronella G.,** *Andropogon Nardus*. **Cotton G.,** *Eriophorum*. **Couch G.,** *Agropyrum repens*. **Crab G.,** *Eleusine* and *Panicum sanguinale*. **Creeping Bent G.,** *Agrostis stolonifera*. **Crested Dog's Tail,** *Cynosurus cristatus*. **Deer G.,** *Rhexia Virginica*. **Dog's Tail G.,** *Cynosurus*. **Eel G.,** *Vallisneria spiralis*. **English Rye G.,** *Lolium perenne*. **Esparto G.,** *Stipa tenacissima*. **Feather G.,** *Stipa pennata*. **Feather Sedge G.,** *Andropogon saccharoides*. **Fescue G.,** *Festuca*. **Finger-comb G.,** *Dactyloctenium*. **Finger G.,** *Chloris*. **Fowl Meadow G.,** *Poa serotina*. **Fly Away G.,** *Agrostis scabra*. **Four-leaved G.,** *Paris quadrifolia*. **Foxtail G.,** *Alopecurus pratensis*. **Golden Top G.,** *Lamarckia aurea*. **Guinea G.,** *Panicum jumentorum;* also erroneously used for *Andropogon Halepensis*. **Hair G.,** *Agrostis scabra*. **Hare's Tail G.,** *Lagurus ovatus*. **Hassock G.,** *Deschampsia cæspitosa*. **Herd's Grass** in New England is timothy (*Phleum pratense*); in Pennsylvania, Fiorin (*Agrostis vulgaris*). **Holy G.,** *Hierochloa borealis*. **Hungarian G.,** *Setaria Italica*. **Italian Rye G.,** *Lolium Italicum*. **Japanese Lawn G.,** *Zoysia pungens*. **Job's Tears G.,** *Coix*. **Johnson G.,** *Andropogon Halepensis*. **June G.,** *Poa pratensis*. **Kentucky Blue G.,** *Poa pratensis*. **Large Quaking G.,** *Briza maxima*. **Little Quaking G.,** *Briza minor*. **Love G.,** *Eragrostis elegans*. **Lyme G.** of upholstery is *Deschampsia cæspitosa*. **Marram G.,** *Ammophila arenaria*. **Meadow Foxtail G.,** *Alopecurus pratensis*. **Myrtle G.,** *Acorus Calamus*. **Oat G.,** *Arrhenatherum avenaceum;* also various species of Avena. **Orchard G.,** *Dactylis glomerata*. **Palm-leaved G.,** *Panicum sulcatum*. **Pampas G.,** *Gynerium*. **Pepper G.,** *Lepidium;* also *Pilularia globulifera*. **Plume G.,** *Erianthus Ravennæ*. **Pony G.,** *Calamagrostis stricta*. **Purple Bent G.,** *Calamovilfa brevipilis*. **Quack, Quick, or Quitch G.,** *Agropyrum repens*. **Quaking G.,** *Briza*. **Rattlesnake G.,** *Briza maxima*. **Ray G.,** *Lolium perenne*. **Red Top G.,** *Agrostis vulgaris*. **Reed G.,** *Arundo, Bamboo*. **Reed Bent G.,** *Calamagrostis*. **Reed Canary G.,** *Phalaris arundinacea*. **Rescue G.,** *Bromus unioloides*. **Rhode Island Bent G.,** *Agrostis canina*. **Ribbon G.,** *Phalaris arundinacea*, var. *variegata*. **Rough Bent G.,** *Agrostis scabra*. **Roughish Meadow G.,** *Poa trivialis*. **Rough-Stalked Meadow G.,** *Poa trivialis*. **Rye G.,** *Lolium perenne*. **Sand G.,** *Calamovilfa longifolia*. **Scurvy G.,** *Cochlearia officinalis*. **Scutch G.,** *Capriola Dactylon*. **Seacoast Bent G.,** *Agrostis coarctata*. **Seneca G.,** *Hierochloa borealis*. **Sesame G.,** *Tripsacum*. **Sheep's Fescue G.,** *Festuca ovina*. **Silk G.,** *Agrostis scabra*. **Silver Beard G.,** *Andropogon argenteus*. **Sour G.,** local name for *Rumex Acetosella*. **Squirrel-tail G.,** *Hordeum*. **Star G.,** *Callitriche;* also locally for *Hypoxis* and *Aletris*. **Striped G.,** *Phalaris arundinacea*, var. *variegata*. **Sweet-scented Vernal G.,** *Anthoxanthum odoratum*. **Tall Meadow Oat G.,** *Arrhenatherum elatius*. **Tickle G.,** *Agrostis scabra*. **Tear G.,** *Coix Lachryma-Jobi*. **Texas Blue G.,** *Poa arachnifera*. **Timothy,** *Phleum*. **Tufted Hair-G.,** *Deschampsia cæspitosa*. **Vanilla G.,** *Hierochloa borealis*. **Viper's G..** *Scorzonera*. **White Bent G.,** *Agrostis alba*. **Whitlow G.,** *Draba*, especially *D. verna* and *Saxifraga tridactylites*. **Wood Meadow G.,** *Poa nemoralis*. **Woolly Beard G.,** *Erianthus*. **Worm G.,** *Spigelia;* also *Sedum album*. **Yellow-eyed G.,** *Xyris*. **Zebra G.,** *Miscanthus Sinensis*.

GRASSWORT. See *Cerastium*.

GRATÌOLA (Latin, *grace* or *favor*, from its reputed healing qualities). *Scrophulariàceæ*. This genus contains an unimportant trailing annual, which grows wild in wet, sandy places from Quebec to Fla., and bears yellow fls.. half an inch long, from June to September. *G. aùrea*, Muhl., was once offered by collectors. It is a glandular plant, with lvs. lanceolate, entire or remotely denticulate, and 2 sterile filaments. B.B. 3:162.

GRAVÈSIA (after C. L. Graves, who collected in Madagascar). *Melastomàceæ*. Three species of dwarf warmhouse foliage plants, natives of Madagascar, and cult. in a few American conservatories. For culture and for distinctions from allied genera, see *Bertolonia*, under which name most of the varieties are still known.



985. Asa Gray at 76 years.

guttàta, Triana (*Bertolònia guttàta*, Hook.). Caulescent, erect: branches obtusely 4-angled: petioles long, densely scurfy-powdery: lvs membranous, 5-nerved, rotund at base, slightly scurfy above and spotted, under side and calyx scurfy-powdery. cymes terminal, several-fld. Int. 1865, and first described at B.M. 5524 as *B. guttata*, where the lvs. are shown with fairly well defined, double, longitudinal rows of roundish pink dots. F.S. 16:1696 is probably a copy of B.M. 5524. (See, also, Gt. 1865, p. 385, and B.H. 1865, p. 225.) Var. **supérba**, Hort., I.H. 26:359 (1879) is shown, with more and larger reddish purple spots, which are less regularly arranged. Var. **Legrelleàna** (*B. Legrelleàna*, Van Houtte). An alleged hybrid obtained by Van Houtte and figured in F.S. 23:2407. Coigneux refers this plate to *Gravesia guttata*, but no fls. are shown, nor have the lvs. any spots. The nerves are outlined in white, and some of the cross veins for short distances. Var. **Alfred Bleu** is brilliantly spotted and lined with bright red, the nerves boldly outlined, the cross veins interruptedly outlined. I.H. 41:13 (1894). Var. **margaritàcea**, Nicholson (*B. margaritàcea*, Hort. W. Bull=*Sonerila margaritacea*. F.S. 16:1697). See DC. Mon. Phan. 7:537.

GRAY, ASA (Fig. 985), botanist and naturalist, was born in Paris, Oneida county, N. Y., Nov. 18, 1810, and died in Cambridge, Mass., Jan. 30, 1888. His father was a tanner. He studied medicine, but never practiced it. He early became interested in botany, and entered into correspondence with Dr. Lewis C. Beck and Dr. John Torrey, both of whom were well known botanists of the time. In 1833, Gray became assistant to Torrey, who held the chair of chemistry and botany in the New York College of Physicians and Surgeons. From this connection dates his serious botanical work. His first book, the "Elements of Botany," appeared in 1836. To the schools, however, he became best known through his "Lessons," which first appeared in 1857. To the last revision of this book, in 1887, he gave the name "Elements of Botany," thus reviving the title of his maiden effort. The "Botanical Text Book" first appeared in 1842: it went to a sixth edition in 1879. From the first this work was accepted as the highest authority on the subjects which it treated; and it is to-day the model for the formal presentation of morphology and taxonomy. Gray is further known as an author of text-books in the admirable books for youth, "How Plants Grow," 1858, and "How Plants Behave," 1872. Gray's texts at once became standards, and have done more to make botany teachable in the schools than any other American works. They are expressions of the older or topical method of presenting plant subjects, as contrasted with the newer ideals which first introduce the pupil to biological or life problems. They will always be known as having marked an epoch in the teaching of botany in America.

Gray was chiefly known for his taxonomic and descriptive work with plants. It fell to his hand to review the North American flora. The western country was largely unknown botanically. The collections of government surveys and of individuals went to him for study. His publications on this new flora are voluminous and critical. He also reviewed the floras of many of the Pacific islands and of Japan. His most ambitious work was the "Synoptical Flora of North America." This great work began to appear in 1838, at which time he was a junior author with Torrey. After having passed to two volumes, comprising the orders from Ranunculaceæ through Compositæ, the work was discontinued until, in 1878, he published the Gamopetalæ after Compositæ. In 1884, he published the families from Caprifoliaceæ through Compositæ. The necessity of studying the wealth of new material resulting from the extension of the national domain made the completion of the work impossible in the interim. The work is still in progress by Gray's successors.

Gray's most widely known systematic work is the "Manual of the Botany of the Northern United States," which first appeared in 1848, and which he took through five editions. The sixth edition, from the hand of Sereno Watson, Gray's successor in taxonomic work, appeared in 1889. From the first it has been the standard flora of its region. In 1868, Gray supplemented the manual by the "Field, Forest and Garden Botany," which was designed as an easy introduction to the commoner wild and cultivated plants. Gray regarded this as his poorest work, yet it met a need and has been deservedly popular. It has been our most acceptable account of cultivated plants. It lacks the critical spirit of his other works, and the accounts of the cultivated plants were drawn largely from literature, rather than from the plants themselves. Working chiefly with taxonomic questions, Gray found little interest in plants which, by domestication, have been made to vary to the confusion of the old specific bounds. Yet it is remarkable how accurately he indicated the species which have been chiefly concerned in the evolution of garden forms, and how comprehensively he covered the field of the domestic flora. A revision of the "Field, Forest and Garden Botany" was made in 1895.

In his view of species, Gray accepted the dominant English ideal as held by the Hookers and by Bentham. Species were large conjunctive groups: he tended to make few rather than many. There were indications of a revolt from this point of view in the later years, but his personality and influence prevented any great defection. At the present time, the pendulum seems to have swung to the opposite extreme. Species are small disjunctive groups: authors tend to make many rather than few. It will probably be a decade or more before the species-ideal swings back to the middle point, where only a pendulum can rest.

Gray was a philosophical naturalist. He was one of the first of the great American naturalists to espouse the main argument of Darwin's "Origin of Species." In this respect he stands in bold contrast to his great colleague Agassiz. Gray's influence was the greater because he was known to be a pronounced theist. He entered the conflict which arose between organic evolution and theology, and did much to heal the schism. His writings on the evolution controversies were published in two volumes, "Darwiniana" and "Natural Science and Religion."

Gray was a constructive philosopher, as well as a critic. His essay on the "Relations of the Japanese Flora to that of North America," was one of the first masterful attempts to explain the principles of the distribution of species. This essay stands for the following conceptions: that species have one origin; that distribution over the earth is due to physical causes; that the origin of the north temperate flora is circumpolar. One who is unfamiliar with the points of view of his time cannot catch the full significance of these conclusions. They are now accepted, not challenged. Into philosophical discussions of cultivated plants he made few excursions, although his paper on the running out of varieties has become a standard; and in his many reviews he made occasional contributions to this field.

Asa Gray was a lovable man. He was gentle, quiet, sweet-tempered; intellectually he was keen and penetrating. Both by his personality and his teaching, he exerted an incalculable influence on American botany, and, indeed, on American biological science. In Europe he became a representative of what was best in American science. Harvard College, in which he held a professorship from 1842 until his death, became the Mecca of every American botanist. Here he built up the most important herbarium and botanical library in the New World. He was the master of American botany.

Gray's writings were voluminous. He was known as one of the most skilful of American reviewers and biographers. His scattered untechnical writings were republished in two volumes in 1889, by Professor Sargent, as the "Scientific Papers of Asa Gray." See the "Letters of Asa Gray," 2 vols., 1893, by his widow, Jane Loring Gray.

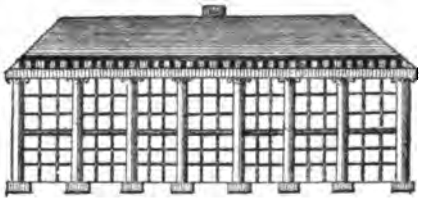
L. H. B.

GREENHOUSE. In America the word Greenhouse is used generically for any glass building in which plants are grown, with the exception of coldframes and hotbeds. Originally and etymologically, however, it means a house in which plants are kept alive or green: in the Greenhouse plants are placed for winter protection, and it is not expected that they shall grow. The evolution of the true Greenhouse seems to have begun with the idea of a human dwelling house. At first larger windows were inserted; and later, a glass roof was added. In early times it was thought best to have living rooms above the Greenhouse, that it might not freeze through the roof. Even as late as 1806, Bernard McMahon, writing in Philadelphia, felt called upon to combat this idea. The old or original conception of a Greenhouse as a place for protecting and storing plants is practically extinct, at least in America (Fig. 986).

Other types of plant houses are the conservatory (which see), in which plants are kept for display; the forcing-house (see *Forcing*), in which plants are forced to grow at other times than their normal season; the stove or warmhouse; the propagating pit. Originally the warmest part of the plant-house, that part in which tropical plants were grown, was heated by a stove made of brick, and the house itself came to be called a stove. This use of the word stove to designate the warmest part or room of the range is universal in England, but in America we prefer the word warmhouse (and this word is used in this Cyclopedia). Originally, hothouse was practically equivalent to stove, but this term is little used in this country, and when used it is mostly applied generically in the sense of Greenhouse.

It will thus be seen that there is no one word which is properly generic for all glass plant houses. The word glasshouse has been suggested, and it is often used in this work; but there are other glass houses than those used for plants. It seems best, therefore, to use the word Greenhouse for all glass buildings in which plants are grown; and usage favors this conclusion.

The long, low Greenhouse range, of the type which we now know in our commercial establishments, probably had a different origin from the high-sided Greenhouse. The glasshouse range appears to have developed from the practice of protecting fruits and other plants against a wall. In European countries, particularly in England, it is the practice to train fruits and other plants on stone or brick walls, in order that they may be protected from inclement weather and receive the greater sun heat which is stored up in the masonry. It occurred to Nicholas Facio Duilhier to incline these fruit walls to the horizon so that they would receive the greater part of the incident rays of the sun at right angles. He wrote a book on the subject of "Fruit-Walls Improved," which was published in England in 1699. Facio was a mathematician, and he worked out the principle of the inclined walls from mathematical considerations. Such walls were actually built, but according to the testimony of Stephen Switzer, who wrote in 1724, these walls were not more successful than those which stood perpendicularly. Certain of these walls on the grounds of Belvoir Castle, and over which grapes were growing, received the additional protection of glass sash set in front of the inclined walls and over the vines. In addition to this, flues were constructed behind the wall in order that heat might be given. The construction of hollow heated walls was not uncommon in that day. The satisfactory results which followed this experiment induced Switzer to design glass-covered walls. The "glasshouse" which he pictured in the "Practical Fruit-Gardener" (1731) represents a Greenhouse 3½ ft. wide in the clear, Fig. 987. At the back of this house is an inclined heated wall on which the grapes are grown. Three and one-half ft. in front of this, a framework is erected to receive the sash. There are 3 tiers of openings or windows along the front, the two lower ones of which are for window sash, and the upper one is vacant in order to provide for ventilation and to allow space to receive the lower sash when they are lifted up. The whole structure is covered with a roof or coping. Switzer declares that the introduction of these covered, sloping walls "led the world" to the "Improvement of glassing and forcing grapes, which was never done to that Perfection in any Place as it is upon some of the great Slopes of that elevated and noble Situation of *Belvoir Castle*." Johnson, in his "History of English Gardening," quotes the remarks of Switzer, and makes the statement that the use of these walls "led to the first erection of a regular forcing structure of which we have an account." The immediate outcome of these covered walls seems to have been the lean-to Greenhouse, and from that has developed the double-span glass range of the present day. Long before Switzer's time plants were forced in a crude way, even by the Romans, mostly by being placed in baskets or other movable receptacles, so that they could be placed under cover in inclement weather; but the improvements of Facio and Switzer seem to have been

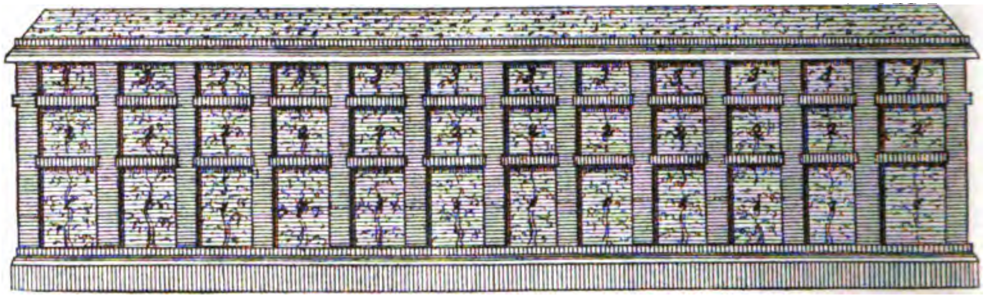


986. The old-time Greenhouse.

With opaque roof and sash-made sides (Abercrombie, 1786).

amongst the earliest attempts to make low glass ranges for plants, particularly in England.

It was about the beginning of the nineteenth century that great improvements began to be made in the glass-house. This new interest was due to the introduction of new plants from strange countries, the improvement of heating apparatus, and the general advance in the art of building. The ideals which prevailed at the opening o the century may be gleaned from J. Loudon's "Treatise on Several Improvements recently made in Hot-Houses," London, 1805. One of the devices recommended by Loudon will interest the reader. It is shown in Fig. 988. The bellows is used for the purpose of forcing air into the house, that the plants may be supplied with a fresh or non-vitiated atmosphere. "By forcing the air into the house, once a day or so, double the quantity of air which the house usually contains" can be secured. The house could be "charged." The tube leading from the bellows is shown at *b;* it discharges at *c.* Curtains run on the wire, *i;* the curtain cord is at *f.*


987. Switzer's glasshouse, built on an inclined wall. 1731.

All commercial structures are now built on the plan of the long, low glass range, with very little height at the eaves. The taller glass structures, if built at all, are used for conservatory purposes or as architectural features. The general tendency of the building of glass structures is towards extreme simplicity (Fig. 1005). In the extreme South, lattice-work buildings are sometimes used for the protection of plants, both from light frosts and from the sun (Fig. 989). The heating which is now employed in this country is of three different kinds: hot water under very low pressure or in the open tank system; hot water in practically closed circuits; and steam. Hot water under low pressure is an old-time idea of heating, and is not now popular in this country except for conservatories and private establishments. The heavy, cumbersome pipes are not adapted to laying over long distances and under varying conditions. The commercial houses are now heated by means of wrought-iron pipes, which go together with threads. The comparative merits of steam and hot water in these wrought-iron pipes are much discussed. For large establishments, particularly those which are on various elevations, and which are likely to be changed frequently, steam is preferable; and, on the whole, it seems to be gaining in favor for commercial establishments. It requires no more attention on the part of the operator, when modern heaters are used, than hot water. However, the merits of one system or the other are very largely those of the individual establishment and apparatus, and the personal choice of the operator (see *Forcing*).

The special American literature on Greenhouse construction and management will be found in the following books: Leuchars' "Hot-Houses," 1850; Henderson's "Practical Floriculture," first ed., 1869; Field's "Greenhouse as a Winter Garden," 1869; Hunt's "How to Grow Cut-Flowers," 1893; Taft's "Greenhouse Construction," 1893; Bailey's "Forcing Book," 1897; Taft's "Greenhouse Management," 1898. L. H. B.

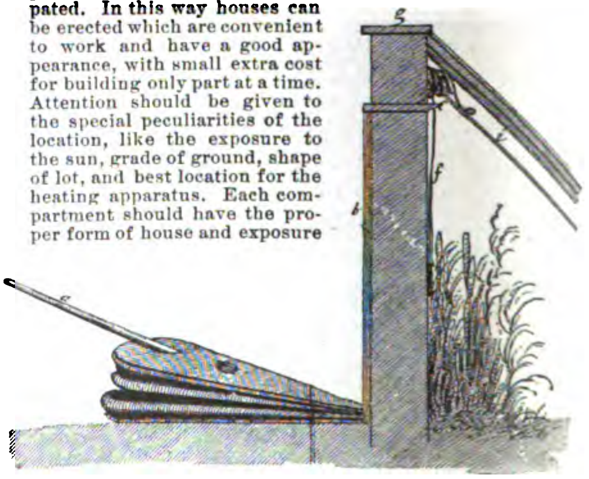
Greenhouse Construction.—For convenience, this subject may be considered under the following heads; i.e., *Location, Plans, Grading, Foundations, Framework, Glazing and Painting, Plant Tables, Ventilation, Heating.*

Location.—Greenhouses which are intended for use in connection with the garden should be placed, for convenient attendance, within the garden inclosure or along its boundary. A good location for the garden will usually be found the best one for the Greenhouse.

A conservatory or Greenhouse designed for a private place, where specimen and blooming plants will be kept for the pleasure of the family and entertainment of visitors, should be attached to the dwelling or located as near as possible in a well-kept part of the grounds. A conservatory does not require a full southern exposure. Most decorative plants thrive as well or better and continue in bloom for a longer time if kept in a house having plenty of light, but so located as to receive but little direct sunlight. Large ranges of glass adapted to a variety of purposes are generally kept separate from other buildings. In parks the location should be near a main entrance.

The location of a range of glass for commercial purposes, where the elements of expense and profit are to have the first consideration, is of great importance. The chief items which determine the desirability of a suitable location are the adaptability and value of the land, cost of fuel delivered, ample and inexpensive water supply, and proximity to a market. The top of a bleak hill or the bottom of a valley should both be avoided. Level land, or that having a southerly slope, is the best.

Plans.—When a site for the proposed Greenhouse has been decided upon, full plans should be made before commencing to build. The plans should embrace not only the glass, which is required at once, but should provide for the largest increase which can be anticipated. In this way houses can be erected which are convenient to work and have a good appearance, with small extra cost for building only part at a time. Attention should be given to the special peculiarities of the location, like the exposure to the sun, grade of ground, shape of lot, and best location for the heating apparatus. Each compartment should have the proper form of house and exposure



988. Loudon's device for charging a Greenhouse with air. 1805.

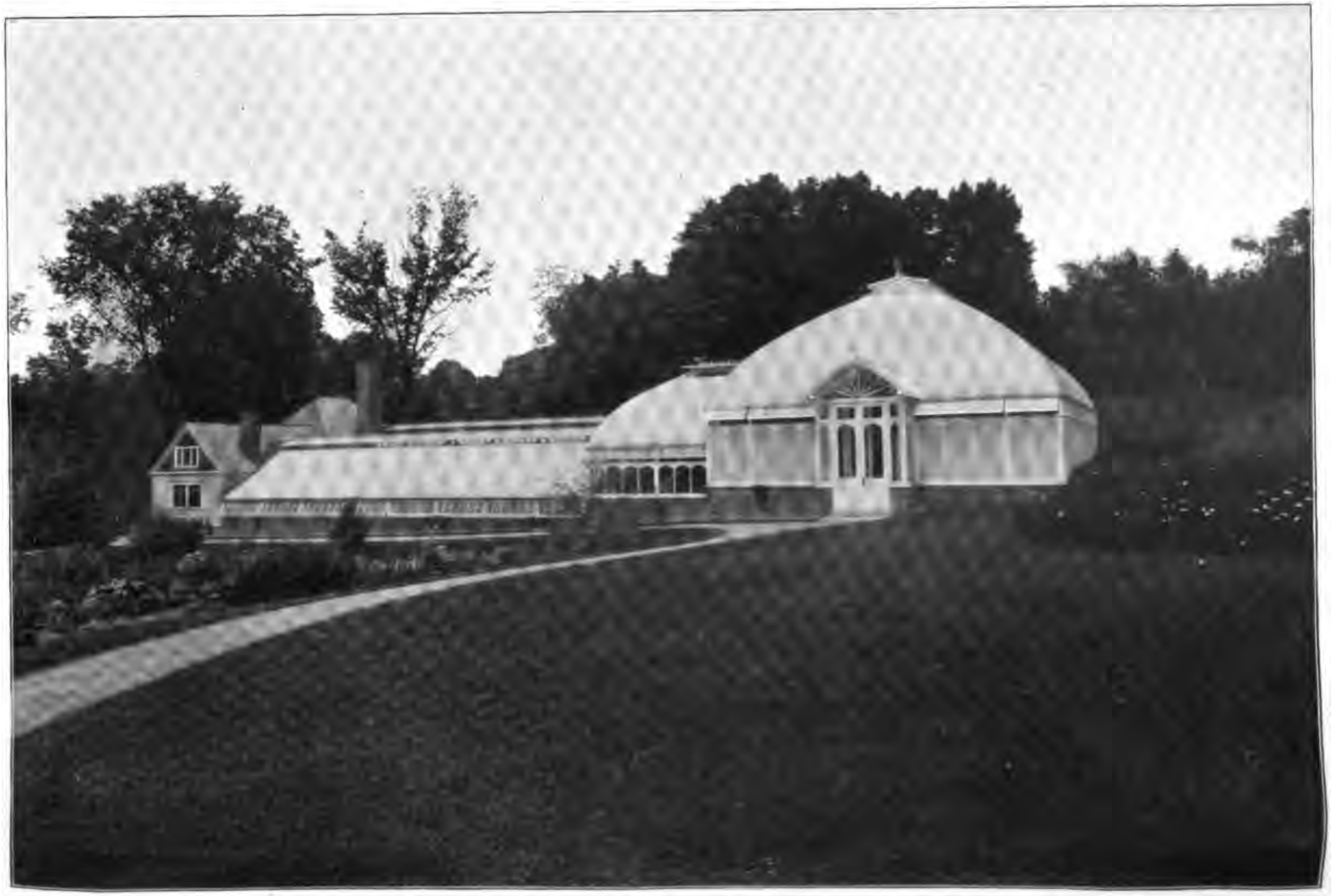
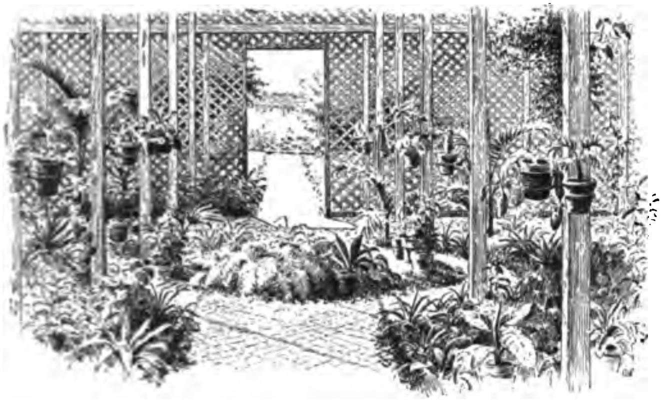


Plate XIII. A Glasshouse range, comprising various types of houses.—Smith College Northampton, Mass.

to the light adapted to the plants for which it is provided.

It will readily be seen that to locate and plan a range of glass to the best advantage requires skill and experience. In a communication recently received by the writer from a superintendent of one of the most important botanic gardens in the country, it was remarked that "when the architect prevails, the gardener fails." It is also true to a greater degree than in almost any other class of buildings that the beginner or amateur who undertakes to plan and construct his own Greenhouse is likely to pay well for his experience, and will at least sympathize with the "lawyer who pleaded his own cause and found he had a fool for a client." This is perfectly true, as many know to their cost. To plan a Greenhouse satisfactorily the designer must have a practical knowledge of the requirements. To meet this increasing demand, specialists can be found, known as "horticultural architects," who devote their entire time to this branch of work.



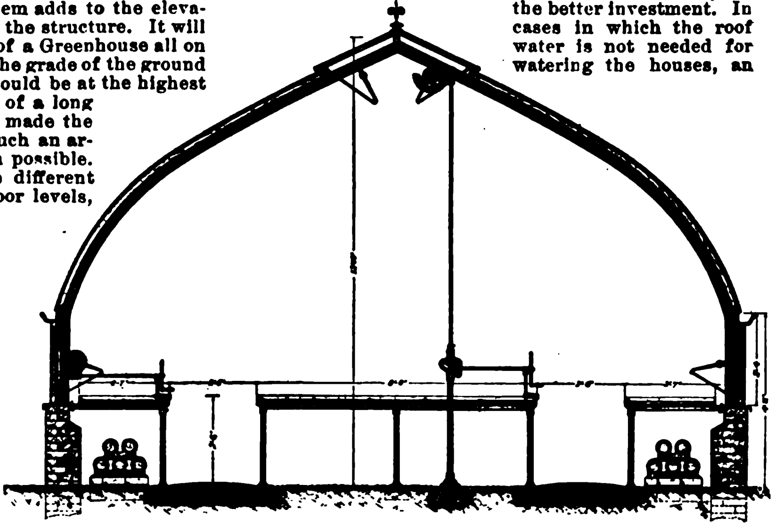
989. A lattice-covered Plant-house.

Grading.—The floor of the Greenhouse should be a few inches above the outside grade. As most Greenhouses are necessarily built low to accommodate the plants, a small terrace around them adds to the elevation and the good appearance of the structure. It will usually be best to keep the floor of a Greenhouse all on one level. When the variation in the grade of the ground is not too great, the floor line should be at the highest point of the grade. In the case of a long house, the floor line is sometimes made the same as the natural grade, but such an arrangement is to be avoided when possible. For locations on a hillside, the different apartments may have different floor levels, with necessary steps between them.

All the sod and loam should be removed from the space to be covered by a Greenhouse, and all the filling necessary made with subsoil. The latter should be laid in thin layers and each wet down and thoroughly tamped. Loam used for filling under a Greenhouse is apt to become sour, and will continue to settle for a long time, causing much trouble and annoyance.

Foundations.—Too much care cannot be given to the preparation of good foundations. These are usually of brick, but may be made of stone or concrete. The brick walls take up less room in the house than stone, and are usually less expensive. The foundation walls should be extended down to a point below the frost line, generally 3 or 4 feet deep, and are usually raised about 2 feet above the grade. An inexpensive wall of rubble stone work or of concrete is all that is needed in the ground. The part of the wall showing above grade may be of plain brick or faced with stone, to correspond with the construction of other surrounding buildings. A good substitute for these masonry walls is found in the use of cast-iron posts in connection with double boarding. A removable base at the ground line, which can readily be renewed, adds very much to the value of this construction, making it durable and satisfactory. It has been quite extensively adopted by florists in houses for commercial purposes and for small and inexpensive Greenhouses. It is recommended for such houses.

Framework.—The construction best adapted for conservatories, park houses and Greenhouses, and for private places where the improvements are desired to be permanent in character and attractive in appearance, is the combination of iron and wood. In this system, the main frame which supports the weight and strain is of iron or steel, wood being used in the frames for the setting of the glass, and to form a non-conductor, of great advantage in the heating of the house. The iron work in this style of construction usually consists of cast-iron sills capping the foundation walls, wrought-iron rafters setting on the sills, about 8 feet apart and running from sill to ridge, forming the side post and rafter in one piece, cast-iron gutters, and angle-iron purlins between the rafters, all securely bracketed and bolted together, forming a complete framework of metal, light, strong and durable. The wood used consists of light sash bars for the setting of the glass, sashes for ventilation, and doors. This woodwork being entirely supported by the metal frame, and not being used where it will be continually wet, will be found as durable as any other material, and for many reasons better adapted for the requirements of a Greenhouse roof. This combination system of metal and wood construction has been extensively adopted by florists and large growers of cut-flowers, though generally with the cast-iron post style of foundation. The first cost is somewhat increased over an all-wood construction, but in view of its greater durability and saving in repairs, it will be found in the end the better investment. In cases in which the roof water is not needed for watering the houses, an angle-iron plate is substituted for the gutter, so framed as to allow the snow and ice to slide over it, keeping the roof entirely clear from such accumulations, which



990. Even-span curvilinear Greenhouse. With cast-iron piping.

darken a house in the cold winter weather, when light is most needed. The double-boarded sides, when erected with care, are warmer than ordinary masonry walls.

Cast-iron gutters are provided to collect the rain-water from the roof. By exposing the inner side of these gutters to the heat of the house, they are kept free of ice in the winter. Small metal clips fastened with screws are used to connect the wood sash bars to the cast-iron gutters, angle-iron plates and purlins. This method of securing the sash bars in place is very convenient in case of repairs, and renders the structure practically portable. A careful examination of any old Greenhouse will show that the parts of the frame which decay first are those pieces of wood which are joined together, for water penetrating the joints soon destroys the wood. This trouble is largely avoided by arranging the frame so that each piece of wood is fastened directly to the iron frame instead of to another piece of wood. Joints between wood and iron do not rot the wood, the latter being preserved by the corrosion of the metal.

The curvilinear form of house (Fig. 990) is ornamental and particularly well adapted for conservatories, palm houses and show houses of all kinds. It is preferred for vineries and fruit houses, as the form allows the canes to be supported on the line of the roof without a sharp bend at the plate line. The light in a curved house, being admitted at different angles, is better diffused and more natural than when reflected through a long pane of straight glass. The cost of a curved roof is slightly greater in the construction, but the arched frame is stronger and will keep its shape better than a house with straight lines, thus largely compensating for the extra cost. For special purposes and locations, special forms of frames may be used. Good forms of commercial houses are shown in Figs. 991, 992. The latter is the most popular form for the forcing-house.

For small Greenhouses and those adapted for the use of amateurs, a frame made chiefly of wood will be found quite satisfactory. An improved method of framing is to use small rafters of wood from 5 to 8 feet apart, with cast-iron brackets at ridge and plate; these rafters are connected by light angle-iron cross purlins, and the latter support very light sash bars spaced for glass between the rafters. The ridge is usually supported by gas pipe posts, and when the rafters are of considerable length additional supports are placed under their centers, instead of darkening the house by rafters of greater size. In this way the roof can be made as light as the metal construction first described, and will nearly approach it in durability and finish. Details of construction of wooden houses are shown in Figs. 993, 994.

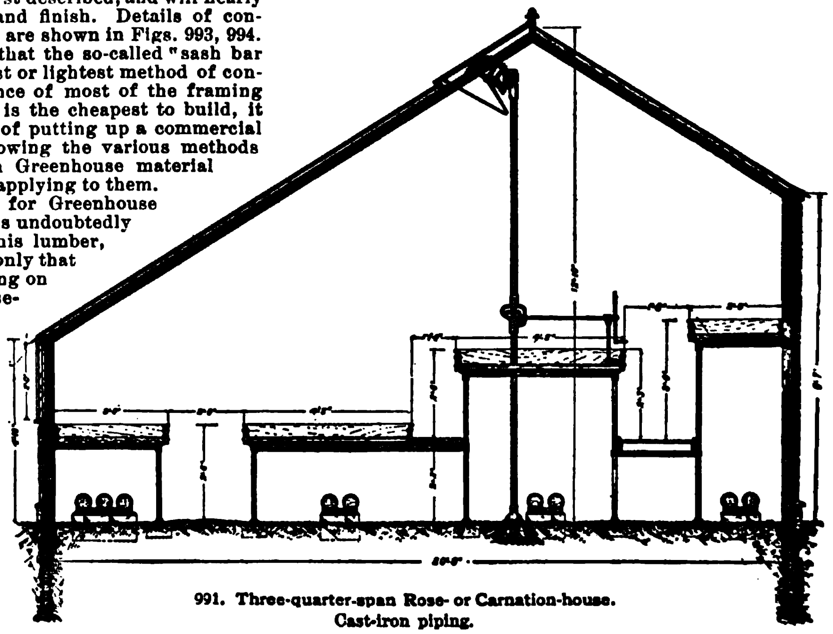
It is generally admitted that the so-called "sash bar construction" is not the best or lightest method of construction, but as the absence of most of the framing reduces its cost so that it is the cheapest to build, it remains a popular method of putting up a commercial Greenhouse. Circulars showing the various methods adopted by the dealers in Greenhouse material can readily be obtained by applying to them.

The best wood to use for Greenhouse framework and plant-beds is undoubtedly cypress. In purchasing this lumber, care should be taken that only that grown in the states bordering on the Gulf of Mexico be selected. This will be found of a dark red or brown color, quite soft and easily worked. There is an inferior variety of cypress growing farther north, which is light in color, hard and springy, and apt to be shaky. As the latter variety is cheaper than red gulf cypress it is frequently used by those who do not know the difference, to the serious detriment of the work and the loss of reputation of cypress for such purposes.

In the market there are three grades of cypress lumber, and it is important to know which to select. The best grade is known as "firsts and seconds," and calls for lumber with a small amount of sap on the edges and occasionally a small sound knot. This is the quality which should be ordered for all the framework of the roof, sash-bars, etc. In order to make the material entirely free from sap there will be a waste in cutting up this quality of from 10 to 20 per cent. The second grade is known to the trade as "selects." This name indicates that it has been graded so that one face of each piece of lumber is of about the same quality as the "firsts and seconds," the other face generally being largely sap. This quality is only fit for outside boarding in Greenhouse construction; it has too much sap. The cost is usually about five dollars per thousand less than the best grade. As it looks to the inexperienced eye almost the same as the best grade, too much of it finds its way into Greenhouse structures. Such sap lumber will not last more than from two to five years. Too great care cannot be exercised to avoid its use. The third grade of cypress lumber is termed "cutting up," and is so called because it embraces all the pieces which have imperfections, such as large knots, splits, etc., which bar them from the better grades. This is a good quality to purchase for base boards and plant tables, for by cutting out the sap and objectionable knots it will be found satisfactory for these purposes. The "cutting up" grade costs about ten dollars less per thousand than the "firsts and seconds." The percentage of waste in cutting up will be somewhat greater than in the other grades.

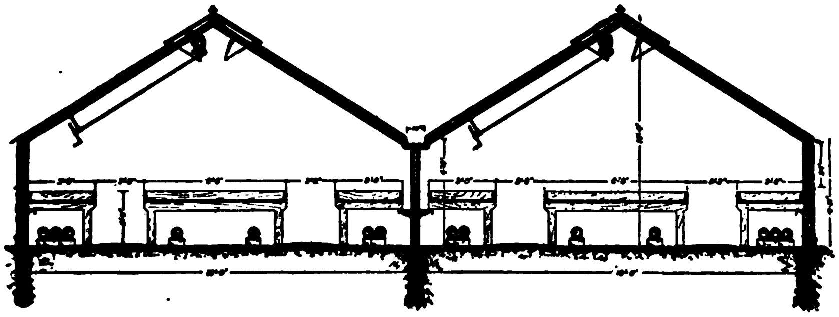
Cypress lumber which has been in use for gutters, sash-bars, plates, etc., in Greenhouses where high temperatures have been maintained is still, after many years, apparently in as good condition as when first used. Owing to the porous texture of the wood, the paint, when applied, sinks in and does not make as fine a coat as on some other woods, but because of this fact the paint adheres to the wood better and lasts longer.

Glazing and Painting.—Ordinary sheet or window glass is in general use for greenhouse glazing. It is better to use only the thickness known to the trade as "double thick." This weighs from 24 to 26 ounces per square foot. The thickness known to the trade as "single thick" weighs only about 16 ounces to the square foot, and is entirely too frail for the purpose. There is very little difference at present in the quality of the imported French or Belgian and the American



991. Three-quarter-span Rose- or Carnation-house. Cast-iron piping.

glass. The weight of most of the glass of American manufacture is about 2 ounces greater per foot than the imported, and therefore proportionately stronger. This greater strength is of considerable importance in the additional security which it affords from damage caused by that enemy of the florists, the hail storm. There is a great difference in the quality of the glass made by different manufacturers in its adaptation to Greenhouse use. This difference is caused chiefly by the quality of the material used in the glass, making it more or less opaque, and in the number of small knots, causing lenses, which concentrate the sun's rays and burn the foliage of the plants. This last defect in the glass cannot be wholly guarded against, as the product of a factory does not always run the same, so that any favorite brand cannot be fully relied upon in this respect. The lenses which burn will be found in all the different grades of glass, firsts, seconds and thirds, with little, if any difference, the grading being done chiefly for other defects, such as affect the value of the glass for window purposes. For these reasons, in selecting the glass for a Greenhouse, it requires experience to decide what make of glass it will be best to purchase. It will be well to purchase from some one who makes a specialty of furnishing glass for Greenhouses, or call in the aid of some friend who has had experience in building, and can give intelligent advice.


992. Even-span Houses.
Heated with water in cast-iron pipes.

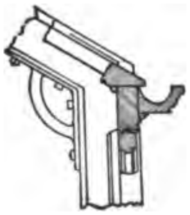
The second quality of glass is usually selected for the best Greenhouse work. The standard widths are from 12 to 16 inches, and lengths vary from 16 to 24 inches. A favorite size is 16 by 24 inches. This is about as large as it is practical to use double thick glass, and makes a roof with comparatively few laps.

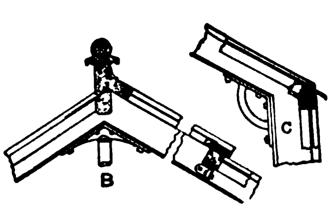
It is not safe to purchase fourth quality of glass or the so-called "Greenhouse glass" frequently offered by window glass dealers, as both of the grades contain the culls and lights only fit to glaze cheap sash for market gardeners, and is of doubtful economy even for this purpose. Rough plate or ribbed glass is not adapted for a Greenhouse roof. It not only obscures the light, but is so brittle that the breakage is greater than with the double thick sheet-glass. It is also very difficult to set it so as to make a tight roof on account of the uneven lines of the ribbing. Recently a few conservatories have been glazed with thick, polished plate-glass, making very handsome roofs, but rather expensive.

To set glass properly in a Greenhouse roof, it should be bedded in the best putty on wood sash bars and lapped at the joints. The bars should be spaced accurately, so that the glass will fit the rabbets with not over one-sixteenth of an inch allowance, and the panes of glass should lap each other not more than from one-eighth to one-quarter of an inch. Zinc shoe nails fasten the glass best, using from 4 to 6 to each pane, according to the size of the light. No putty should be used on the outside of the glass. A comparatively new system of glazing has been adopted by some florists, in which no putty is used, but the glass is placed directly on the rabbets of the bars and the ends of the panes are butted together and held in place by wood caps fastened to the sash bars. This system does not make a tight roof, allowing considerable water to enter the house through the joints, nor does it provide any means of escape for the condensed water from the under side of the glass, which is a very serious objection. In ordinary glazing, where each light laps over the one below, the condensed water passes through the joints to the outside, forming a perfect remedy for this trouble. The difference in the cost is very slight, if anything, provided the work is equally well done, as the value of the putty omitted is fully offset by the extra cost of the caps.

The painting of a Greenhouse roof is a very important part of the work. Owing to the extremes of heat, cold, dryness and moisture to which it is exposed, the conditions are decidedly different from ordinary buildings. Three-coat work is the best. The priming coat on the wood work should be mostly oil, and, as far as possible, the material should be dipped into a tank of paint. Iron and steel framing material should be primed with a metallic paint. The priming coat should be applied before the material is exposed to the weather. The material of the second and finishing coats should be pure linseed oil and white lead. Experience has shown that this material is the best for this work. The color should be white, or a light tint of any desired shade may be used, but no heavy color should be adopted which requires coloring matter in place of the lead in the mixing. Each coat should be applied thin and well rubbed out. While the appearance may not be quite as fine when the work is first done, the paint will not peel off, and will last longer and form a better protection for the structure than when it is put on in thick coats. It will also form a good base for repainting, and this should be done in a similar manner. It is economical to repaint a Greenhouse every two years, and generally one coat will be sufficient.

Plant Tables.—Stages for plants in pots or raised beds for planting out usually cover the entire area of a Greenhouse, except the walks, and their cost constitutes a considerable proportion of the expense. Palms are usually grown in solid beds or in pots or boxes sitting on the ground. Many vegetables are grown in solid beds near the ground level. Roses and carnations are usually in raised beds. Angle-iron frames supported on adjustable gas pipe legs, with slate or tile bottoms, form the best plant tables (Fig. 995). Wood bottoms, which can be readily renewed, are frequently substituted, saving a part of the first cost. When the table supports are of wood care should be taken that they are not fastened against any part of the framework of the house, unless iron brackets are used so as entirely to separate the woodwork.


993. Details of gutter.



994. Details of ridge (B) and eave (C).

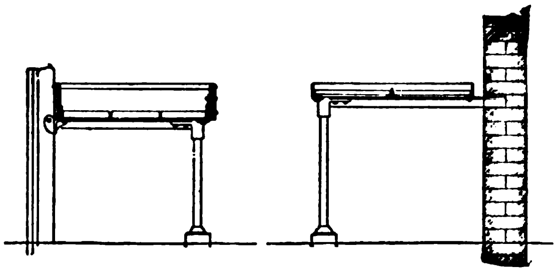
Ventilation.—No Greenhouse is complete without a good ventilating apparatus. About one-tenth of the roof should be arranged to open or close for ventilation, though this percentage will vary according to the form of house and the purpose for which it is used. It is not desirable to open all the ventilators in a long house with one set of apparatus, for frequently one end will not need as much ventilation as the other end, or may be affected by the wind forming a current lengthwise of the house. To avoid this a Greenhouse 200 feet long should have 3 or 4 sets of apparatus, which can be operated separately. In all Greenhouses of considerable width, it is desirable that ventilation should be provided on both sides of the ridge, so that the ventilation can be given on the "leeward" side, which will prevent the wind from blowing directly into the house.

Heating.—The success of the florist, gardener or amateur in the management of a Greenhouse depends largely on the satisfactory working of the heating apparatus. There are two systems of Greenhouse heating which, when the apparatus is properly installed, are economical and satisfactory; viz., hot water and steam. The open-tank hot water heating has more advantage in its adaptation to general use than any other, and is so simple that its management is readily understood by any one. It is practically automatic, and is capable of maintaining an even temperature for ten hours without attention. Low pressure steam heating is well adapted to large commercial ranges, and to large conservatories in parks and private places, where a night attendant can be kept in charge of the fires to turn on and shut off steam from the radiating pipes as the changing outside temperature may require. The heating of Greenhouses to the best advantage under the varying conditions of climate and interior requirements, demands, like the designing of Greenhouses, the services of an experienced specialist in horticultural work.

Lord & Burnham Co.

Greenhouse Glass.—The selection of glass for Greenhouses, and the nature of the imperfections which render it undesirable for such use, are questions which have received much attention from horticultural writers, and which have brought forth a variety of answers. Three qualities are essential in all glass to be used in Greenhouse construction: first, minimum of obstruction to solar rays; second, strength sufficient to withstand the strain of winds and storms, especially hail; and third, freedom from defects rendering it liable to burn plants grown under it.

It is an established fact that plants thrive best under a clear and transparent glass, which lets through the greatest possible percentage of the sun's rays. This includes all the solar rays, calorific or heat rays and actinic or chemical rays, as well as the colorific or light rays. Clear white glass of the grade known as "single thick" (12 panes to the inch) lets through from 60 to 70 per cent of the sun's rays, common green glass of the same thickness, 52 to 56 per cent, and "double thick" (8 panes to the inch) common green glass from 50 to 52 per cent. This percentage is reduced by other colors, dark blue glass letting through but 18 per cent. In connection with the matter of tint, it should be noted that some glass, especially clear white glass purified with arsenic acid, or that in which a large amount of potash is used in proportion to the amount of lime used in manufacture, becomes dull after long exposure to the weather, the dullness being occasioned by the efflorescence of salts contained in the glass. Before this disintegration has proceeded too far, the crust or efflorescence may be removed with muriatic acid.



995. Details of iron-frame benches.

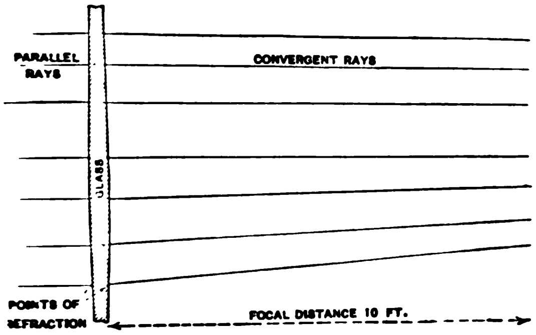
The strength of glass depends upon its thickness and the thoroughness of the annealing. Glass is annealed by passing through a series of ovens, where it is raised to a high heat and then gradually cooled, whatever toughness and elasticity the finished product may contain being due to this process. The thickness of glass varies, not only with grades (single and double thick), but also more or less within the grades, and even with different parts of the same pane. Single thick glass is too thin for use in Greenhouses, and in selecting any glass for such a purpose it should be examined pane by pane, and all showing marked variation in thickness, either between panes or in different parts of the pane, rejected. A pane of varying thickness is much more liable to breakage from climatic changes or sudden shocks than one which is uniform in this regard. From the foregoing statements it will be seen that, in general, the ordinary double thick green glass is best, as regards both tint and strength, green glass being less liable to change in tint than white, and the double thick being the stronger grade. By green glass is meant simply the ordinary sheet glass, the green color of which is only noticeable when looking at a cut edge.

996. Burned areas on a Begonia leaf.

The idea has long been more or less prevalent that such visible defects in sheet glass as the so-called "bubbles," "blisters" and "stones," produce a focusing of the solar rays passing through them, thus burning the foliage of plants grown under glass containing these defects (Fig. 996). This view has been held by glass manufacturers and horticulturists alike, and seems not to have been publicly contradicted until 1895 (Bull. 95, Cornell University Agric. Exp. Sta., p. 278). In view of the erroneousness of this theory, it is rather remarkable that it should have gained such prevalence. Nearly all bubbles and blisters are thinner in the middle than at the periphery, being thus concave rather than convex lenses, and actually diffusing the rays of light passing through them rather than producing destructive foci. While it is true that sand stones or knots in glass may produce foci, these points of focus scarcely ever exist more than a few inches from the surface of the glass, and consequently these defects can do no damage when occurring in roofs several feet distant from the growing plants below.

The only full and complete series of experiments on this subject in this country (conducted at the Cornell University Agricultural Experiment Station, the Physical Laboratory of Cornell University, and a glass factory in Ithaca, New York, but yet unpublished) shows the true cause of the burning by glass to be the variation in thickness of the entire pane, or portion of same, thus causing a prismatic or lens-like effect (Fig. 997), which causes a more or less distinct focussing of the sun's rays at distances varying from 5 or 6 feet to 30 feet, or even more, from the glass.

This defect usually occurs along the side or end of the pane, and is not visible to the eye, but may be easily detected by the use of the micrometer caliper or by testing in the sunlight. It may be found in all kinds of glass, and is caused by a reduction of the upper or pipe end of the cylinder from which sheet glass is made, by the glass blower, to facilitate the removal of the "cap" or neck end of the cylinder, by which it is attached to the pipe while being blown. The defect, as before stated, is one which may be found in all grades and qualities of sheet glass, of both foreign and domestic manufacture. The fact is well known that differences in the thickness of spectacle lenses, which are imperceptible to the eye, may produce sufficient refraction to materially vary the direction of rays of light passing through such lenses, and it is not difficult to see that the same effect may be produced by similarly imperceptible variations in the thickness of sheet glass. That this is the case has been conclusively shown by the series of experiments before mentioned. These also show that burns on plants, caused by defective glass roofs, occur in lines and not in isolated spots, burns of the latter description being usually the result of a weakening or deterioration of tissue, due to carelessness in the matter of ventilation, humidity of the atmosphere and water, and temperature of Greenhouses, rather than to defects in the glass of roofs.



997. Refraction of light rays by an irregular pane of glass.

If, therefore, it is not possible to obtain glass of uniform thickness with certainty, it may be found cheaper and often fully as satisfactory to purchase the lower or common grades of double thick glass, using in the roof only those panes which show, after testing in the sunlight for foci, an entire lack of the prismatic character which makes them dangerous to plants grown under them.

J. C. Blair.

Greenhouse Heating.—In all sections in which the temperature drops below the freezing point, it is necessary to provide some artificial means for heating Greenhouses. Nearly all modern structures are warmed either by steam or hot water, although hot air flues are occasionally used. While hot water is preferred for small ranges of glass, as it can be depended upon to furnish an even degree of heat when left for a number of hours, steam is more commonly used for extensive plants, as the cost of piping the houses is much less than when hot water is used. Steam boilers require more attention than hot water heaters, but when there is more than 10,000 or 12,000 square feet of glass, it is best to have a night fireman and watchman, and the extra expense can be made up by the saving in the cost of fuel, as it will be possible to use a lower grade of coal. Under these conditions the cost of running a steam plant will be as low as with hot water, but in small houses, where hard coal is used, and the fires receive no attention for six to eight hours during the night, hot water heaters will be cheapest to operate, and will be most satisfactory. See, also, the article *Forcing*.

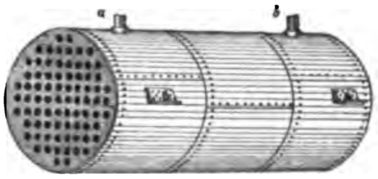
As the various flowers and vegetables grown under glass require different temperatures, the piping of Greenhouses has to be varied accordingly. Thus, although it may vary from 3 to 5° for different varieties of the same species, our common plants require the following night temperature: violets and lettuce, 45 to 50°; radishes and carnations, 50 to 55°; roses and tomatoes, 60°; cucumbers and stove plants, 70°.

Boilers.—Whether steam or hot water is used for heating, the best boilers for houses with less than 2,000 feet of radiation are of cast iron, but for larger houses, especially when steam is used, boilers of a tubular pattern are commonly preferred. Although it is not usually practiced, it will be safest and often cheapest in the end if two or more boilers of medium size are used instead of one large boiler of the same capacity as the small ones combined. When only one boiler is used it might result in the loss of all the plants in the house if any accident should happen to it in severe weather, while if two or more boilers are used, and are so arranged that any of them can be cut off, the danger from this source will be greatly lessened. The use of two or more small boilers will also be found much more economical than one large one during the fall or spring, when it will be far cheaper to maintain a fire in one of the small boilers than in a large one.

In selecting a boiler, it is always desirable to have one sufficiently large to afford the necessary heat without forcing the fire, as this will not only give more satisfactory results, but will result in the economy of fuel and labor, and will prolong the life of the boiler. Boiler makers generally use some definite ratio between the size of the grate and the amount of fire surface in the boiler, but this varies with the size of the boiler and the efficiency of the fire surface. In small hot water boilers, with very effective fire surface, the ratio between the two is frequently as small as 1 to 15, while in larger boilers it is often as great as 1 to 35, and even more where hard coal is used and the boilers have constant attendance. For small Greenhouses it is desirable to have the grate sufficiently large to permit of leaving the fire without attention for eight to ten hours in the severest weather, while for a large range of houses it is customary to employ a night fireman, and a grate much smaller proportionately could be used. In steam boilers the capacity is generally rated at about 100 square feet of radiation for each horse-power; and an average of about 15 square feet of fire surface is considered equivalent to a horse-power, it being customary to estimate that 12 square feet in large boilers and 18 feet in very small ones will equal one horse-power. Thus, in boilers of medium size, an area of 10 square feet of grate will answer for 250 square feet of heating or fire surface, and this will be sufficient for nearly 1,700 feet of radiating surface, where steam is used; and, as hot water requires about two-thirds more radiation, a boiler of the above size will answer for from 2,800 to 3,000 square feet of hot water radiation. In using the above figures for small boilers that will not have attendance during the night, it is generally advisable to make an allowance for this of about 25 per cent, and, when a boiler is required for 1,000 feet of radiation, select one that would be rated at 1,250 feet.

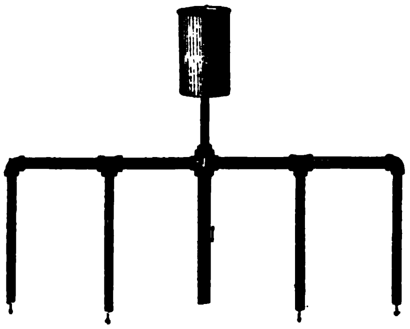
For large ranges, tubular steam boilers will generally be more satisfactory. Good results will be secured from those either of fire-tube or of water-tube construction, and many prefer them when hot water is used; but when tubular boilers are used for hot water heating, although good results may be secured when a regular steam boiler is employed, it is advisable to have them made without a steam dome, and to have the entire shell filled with tubes (Fig. 998). As a rule, these boilers will be less expensive than cast-iron boilers, and if properly cared for, will be nearly as durable.

During the past few years a large number of coil boilers have been constructed for hot water heating. These boilers are generally from 4 to 6 feet long, and are made from wrought-iron pipe, varying in size from 1 to 2 inches in diameter, but when constructed from 1-inch pipe they are not very durable, as the pipe itself is comparatively thin, and wherever the threads are exposed it is quickly eaten through. There is also more trouble from the boiling over of the water than when larger pipes are used, and when boilers are constructed of 1-inch pipe it is necessary to have either an elevated expansion tank or to run it as a closed system. In making the boiler the pipes are cut of the desired length, usually of 5 or 6 feet, and the ends are connected either by return bends or by manifolds, so as to



998. Horizontal tubular boiler for hot water.

form a number of vertical coils, each containing from six to ten pipes. The upper ends of the manifolds are joined at the front end of the heater and connect with a flow pipe, while the lower ends of the rear manifolds are joined to the returns. As a rule, the grate is of the same width as the coil, and from one-half to two-thirds as long. Although a box coil is much cheaper than a cast-iron heater, when we add to its cost the expense for grate, doors and other fittings, and of bricking it in, the amount saved will not be large, especially as the coil boilers are, as a rule, not more than one-half as lasting as cast-iron boilers, most of which are complete and require no brick work or trimmings.



999. Flow and supply pipe for under-bench flows.

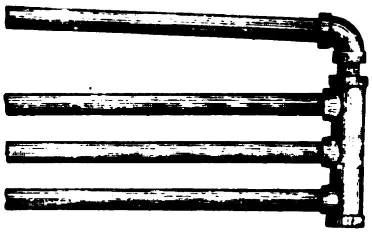
Hot Water Piping.—Modern hot water heating systems do not differ particularly from those in which steam is used, except that larger sized pipes are required to afford the necessary radiation. Formerly 4-inch cast-iron pipes were used in the piping of Greenhouses, but as the joints are packed with oakum, cement or iron filings, they frequently give trouble by leaking, and it is much more difficult to make changes or repairs than when smaller wrought-iron pipes with screw joints are used. Owing to the large volume of water in the pipes, the circulation is necessarily quite sluggish, and it is not easy to secure the high temperature in the water that can be obtained from smaller pipes. Another objection to these large pipes is, that it is not possible to carry the flows overhead, as is often desirable.

When the flow pipes supply a number of houses, or if the heater is at some distance from the Greenhouse to be warmed, it is best to start from the boiler with one large pipe, or with two pipes leading out from different sides of the boiler, rather than to carry independent pipes to each house. If there are several houses to be heated, it is advisable to have the heater located at the north end or side of the houses, as near the center as possible, and carry the flow pipe along the ends of the houses just over the doors, although, if necessary, they may be beneath the level of the doorways. From this main pipe one or more supply pipes can lead into each of the houses. The size of the main feed pipe, as well as of the branch pipes, should be in proportion to the amount of radiation that they supply; and, in determining the amount that can be handled by pipes of different sizes, it is advisable to use somewhat larger supply pipes when all of the radiation, both flow and return, is under the benches than when the flow pipes at least are overhead. A similar allowance should be made when the boiler is partly above the level of the returns, as compared with a system in which the radiating pipes are a number of feet above the top of the boiler, since in the latter case a much smaller supply pipe will suffice. In a general way, the following sizes can be used as supply pipes: 1¼-inch pipes for 75 to 100 square feet of radiation; 2-inch pipes for 150 to 200 square feet; 2½-inch for 250 to 350; 3-inch for 400 to 600; 3½-inch for 600 to 800; 4-inch for 1,000 to 1,200; and 5-inch for 1,500 to 2,000 square feet of radiation. The supply pipes should, if possible, rise vertically from the heater to a point higher than the highest point in the system and then should have a slight fall, say 1 inch in 20 feet, so that there will be no opportunity for the pocketing of air in the pipes. It will, however, make but little difference whether the pipes run up-hill or are given a slight downward slope, and the former arrangement may be used where it will best suit the conditions. In case the pipes are carried under the benches, and it is impossible to sink the boilers much below the level of the coils, it will be well to have the flow pipe run vertically from the boiler to a height of 8 or 10 feet (Fig. 999), and then branch and run horizontally along the ends of the houses, taking off the supply pipes for each and dropping them below the level of the benches.

It is often desirable to have some or all of the flow pipes overhead, as this will greatly improve the circulation and will aid in preventing cold drafts of air upon the plants. Some make use of a single large flow pipe in each house. This is located upon the posts, a foot or so beneath the ridge, and carries the water to the farther end of the house, where branch pipes connect with the coils, but a better distribution of the heat can be secured in houses more than 10 feet wide if two or more pipes are used. These can be upon the ridge and purlin posts, and it is often desirable to have one upon each of the wall plates. The number and size of these flow pipes will depend upon the width of the houses and the size of the coils that they supply. The amount of radiating surface in the flow pipe itself should be added to that in the coil, in determining the size of supply pipe that will be required. For long houses it will often be necessary to use one or more 3-inch pipes, but ordinarily 2-inch or 2½-inch pipes distributed upon the posts and wall plates will give the best results.

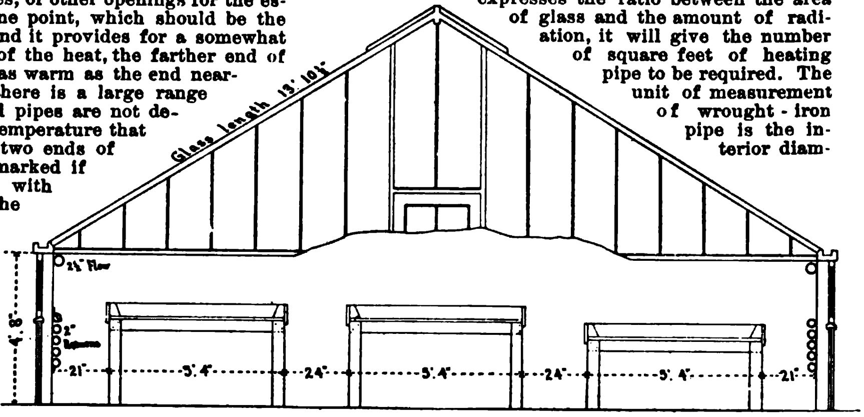
The size of pipe used for the returns will depend upon the length of the coils and their height above the boiler, as the pipes for elevated short coils may be smaller than those of considerable length that are below the top of the boiler. Ordinarily 2-inch pipe will be desirable for coils more than 75 feet in length, and will be preferable to a smaller size when they are only 50 feet in length, if the flows are under the benches and the lowest part of the coils are below the top of the boiler. For short coils, pipes as small as 1¼-inch may be used where they are somewhat elevated, but for ordinary commercial Greenhouses 1¼-inch pipe is better up to 50 to 75 feet, and 2-inch pipe for all others, as, while small pipe furnishes the most effective radiation, the increased friction impedes the circulation.

If a single large flow pipe is used, it is often desirable to have one or more of the returns elevated upon the purlin posts and wall plates, but ordinarily the radiating surface should be distributed upon the walls (Fig. 1000), and under the benches in houses where, as is now generally the case, there are walks along the side walls. In houses in which it is undesirable to have bottom heat, all of the pipes may be upon the walls; and this is also the usual arrangement when solid beds are used, except in wide houses, in which case a portion of the returns may be upon the sides of the beds, beneath the walks, or elevated upon the purlin and ridge posts. The pipes in the coils may be connected at their ends either by means of manifolds or by tees and close nipples, but in either case provision should be made for the expansion of the pipes, which may be done in the case of vertical coils by running them partly across the ends of the houses and in the horizontal coils by the same means, or by placing the header at the lower end of the coil and a foot or so lower, and connecting it with the ends of the pipes by means of nipples and right and left ells.



1000. Pipe work for modern greenhouse heating. A wall coil.

When all of the pipes are under the benches or upon the walls, a single large pipe may be used as a flow to supply all of the others in the coil, or two or more of the pipes of the same size, as the returns may be used as flow pipes. These pipes can be so arranged that they will each supply one or more returns, or they may connect with a header from which all of the return pipes start. Care should be taken to give all of the return pipes a slight fall, and it will be best if this is only enough to insure their being kept free from air. It will be safest to give the smaller pipes a slope of one inch in 15 feet, but 2-inch pipes, if carefully graded and securely supported at intervals of 10 feet, will give good results if the fall is not more than 1 inch in 30 feet. This is often of considerable importance in long houses where it is not possible to sink the heater so as to give the returns a fall of 1 inch in 10 or 15 feet, as is often recommended. It should be understood that better circulation can be secured when a return pipe has but a slight slope if sufficient to keep it free from air, with a vertical drop of the return pipe at the lower end, than when the coil has a much greater fall in running from one end of the house to the other, if this brings the lower end of the coil down to about the level of the main return. The circulation in a coil fed by an under-bench flow will be quite unsatisfactory when the lower end of the coil is below the top of the heater, if it is connected at its own level with the return pipes from other coils, that are considerably higher, and especially if they are fed by elevated flow pipes. When overhead flow pipes are used, the slope of the returns will necessarily be toward the heater, but when the pipes are all under the benches the slope may be in either direction, and if connected at the end nearest the heater it will be necessary to run a return pipe of the same size as the supply pipe, back from the farther end of the house, unless there are a number of houses in the range, when a main return pipe can be run across the farther end of the houses, to which coils can be connected. If a coil is made up of two or more pipes of the same size, a part of which are flows and the others returns, it will be advisable to run all of these pipes down hill; although, if there are only one or two flow pipes, and the lower end of the coil is considerably above the heater, a good circulation can be secured if the flow pipes run up hill to the farther end and are brought back with a downward flow. The downhill system, with a flow pipe running to the farther end of the house, has two advantages, as it does away with the necessity of air valves, or other openings for the escape of air, except at one point, which should be the highest in the system, and it provides for a somewhat more even distribution of the heat, the farther end of the houses being fully as warm as the end nearest the boiler. Where there is a large range of houses and overhead pipes are not desired, the difference in temperature that can be secured at the two ends of the houses will not be marked if the coils are connected with the main flow pipe at the end nearest the boiler, and are joined with a main return pipe passing along the farther end of the houses, and if the coils upon the walls are carried along the ends of the houses to the doors.



1001. Carnation house, 100 x 23 ft. 6 in., piped for hot water.

For all hot water heating plants an expansion tank is necessary (Fig. 999). This may be made from heavy galvanized sheet-iron, or a riveted boiler iron tank may be used. It should be connected with the heating pipes, but the point of connection will make little difference, although when the downhill system is used, if the pipe leading to the expansion tank starts from the highest point of the system it will make the use of air valves unnecessary. The tank may be located only slightly above the highest point of the system, but it will be best placed at least 10 to 15 feet higher, as the elevation of the tank will lessen the danger of the boiling over of the water in the system, and make it possible to secure a higher temperature in the water of the coils than when the tank is not thus elevated. Trouble from the boiling of the water in the heater is most likely to occur when the flow or return pipes are too small, and when the fire surface in the boiler is composed of small, wrought-iron pipes or drop tubes. When there is a proper adjustment between the size of the boiler and the radiating surface, and the return connections are of sufficient size, there will be little danger from it.

Estimating Hot Water Radiation.—Owing to the great variations in temperature and the differences in the construction of Greenhouses and in their exposures, it is impossible to give an explicit rule regarding the amount of radiation to be required under all conditions; but experience has shown that, in well-built houses, any desired temperature can be secured, for various minimum outside temperatures, when there is a certain ratio between the amount of radiating surface and the amount of exposed glass and wall surface, supposing, of course, that there is a proper adjustment between the size of the boiler and radiating surface, and that the system is so arranged as to give good results. Thus, when a temperature of 40° is desired in sections where the mercury does not drop below zero, it will be possible to maintain a temperature of 45° inside the Greenhouse when there is 1 square foot of radiating surface to 4½ square feet of glass. Under the same conditions, 50° can be secured when there is 1 foot of pipe to 4 of glass, and 55°, 60°, 65° and 70° can be obtained when there is, respectively, 1 square foot of pipe to each 3½, 3, 2½ and 2 square feet of glass. For outside temperatures slightly under or above zero, there should be a proportionate increase or decrease in the amount of pipe used, and if the houses are poorly constructed, or in an exposed location, it will be desirable to provide increased radiating surface. Under the best conditions the temperatures mentioned could be obtained with a slightly smaller amount of radiation, but the greatest economy, so far as both coal consumption and labor are concerned, will be secured when the amount of radiation recommended is used. In determining the amount of exposed glass surface, the number of square feet in the roof, ends and sides of the houses should be added, and to this it is always well to add one-fifth of the exposed wooden or other wall surface, and if this sum is divided by the number which expresses the ratio between the area of glass and the amount of radiation, it will give the number of square feet of heating pipe to be required. The unit of measurement of wrought-iron pipe is the interior diameter, while its radiating surface is determined by its outside circumference; and, although it will vary slightly according to the thickness of the pipe, it is customary to estimate that 1-inch pipe will afford about .344 square feet of radiating surface per linear foot, while 1¼-, 1½-, 2-, 2½- and 3-inch pipe will supply, respectively, .434, .497, .621, .759 and .916 square feet of radiation for each foot in length of pipe. The best results can be secured only when the pipes are in straight runs. The use of ells and tees should be avoided whenever possible, but if they must be employed, special hot-water fittings should be secured.

In conservatories with high side walls, it is desirable to place the flow pipes at the plate and the returns on the wall or under the tables. Figs. 1001, 1002 and 1003 illustrate the lay out of pipes for water in a carnation, rose and violet house.

Hot Water Under Pressure.—In some large Greenhouses the hot water systems have been placed under pressure by closing the expansion tank. To prevent any danger of the blowing up of the system, a safety-valve, with a weight set so as to allow the water to escape before the danger point is reached, is attached either to the tank or expansion pipe. The system being completely closed, the water as it warms is placed under pressure, and steam cannot be formed. This makes it possible to raise the temperature of water in the coils quite a number of degrees higher than when an open tank is used. As there is even more danger from an explosion of a system when the water is under pressure than when steam is used, care should be taken to see that the safety-valve is in good working order, and that it is set at a point well below the danger limit.

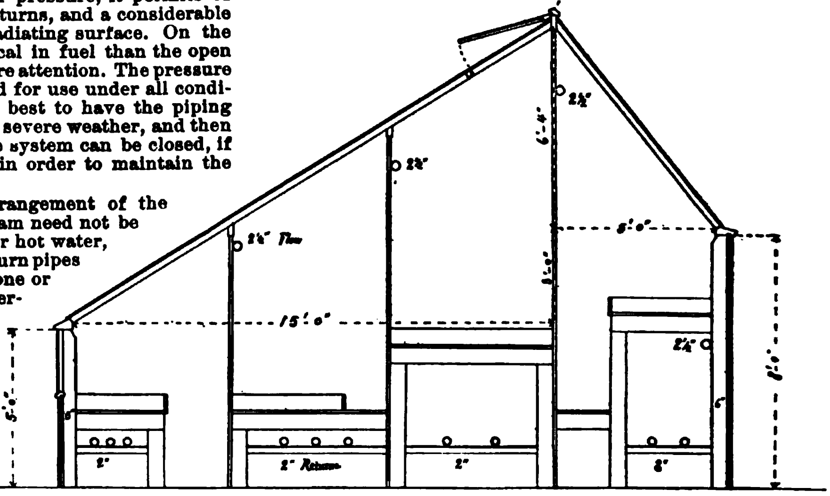
When water is carried under pressure, it permits of the use of smaller flows and returns, and a considerable reduction in the amount of radiating surface. On the other hand, it is less economical in fuel than the open system, and requires rather more attention. The pressure system cannot be recommended for use under all conditions, and it will generally be best to have the piping adapted for all except the most severe weather, and then to have it so arranged that the system can be closed, if it becomes necessary to do so in order to maintain the desired temperature.

Piping for Steam.—The arrangement of the heating pipes for use with steam need not be unlike that above described for hot water, except that smaller flow and return pipes are used. When there is but one or two houses it is well to use overhead flow pipes, as a rule only one being required in a house. A 2-inch flow pipe will be sufficient for 400 square feet of radiation, and 2½-, 3-, 3½- and 4-inch supply pipes will answer, respectively, for 700, 1,000, 1,400 and 1,900 square feet of radiation. For long houses it will be best to use 1¼-inch pipe for the coils, but 1-inch pipe will answer for houses 100 feet or less in length. The coils should, of course, run down hill, but if overhead supply pipes are not used the connection may be made at the end of the house nearest the boiler and the return pipe may be placed underneath the coil. In order to prevent the water from backing up in the coils it is desirable that they should be at least 18 or 20 inches above the level of the water in the boiler, while 3 or 4 feet would be even better. There should be an automatic air valve at the lower end of each coil, and, in order to regulate the amount of steam, a shut-off valve should be placed in both flow and return pipes. Unless there are several coils in each house it will always be well to have valves upon a number of the pipes in the coils, so that all but one or two can be cut off if desired. To prevent the water from being forced out from the boiler when the steam is turned into the houses, there should be a check valve in the return pipe near the heater.

The amount of radiation which will be required to secure any desired temperature will vary to some extent with the amount of pressure that is carried in the boiler, but, as a rule, this is not more than five pounds, and often no pressure at all is used. It will ordinarily be best to have the radiation sufficient to furnish the temperature desired in ordinarily cold weather without carrying any pressure, and then by raising the pressure to from five to ten pounds secure the heat that is needed during cold waves.

In determining the amount of radiation for a steam-heated house, 1 square foot of pipe will answer for 9 square feet of glass, when 40° is desired, and for 7, 5 and 3 where 50°, 60° and 70°, respectively, are required. Fig. 1004 illustrates piping for steam in a rose house.

Heating by Flues.—Where fuel is cheap, and when either a low temperature is desired in the house or the outside temperature does not drop much below the freezing point, hot-air flues may be used, but while the cost of constructing them is not large, the danger from fire is so great that they are not always economical. A brick furnace is built at one end of the house, and from this a 10- or 12-inch flue is constructed to carry the smoke and hot gases through the house to the chimney, which may be at the farther end, or directly over the furnace, the flue in the latter case making a complete circuit of the house. When the houses are more than 60 feet long, it is advisable to have a furnace at each end, and the flue will then extend only to the center of the house and return to the end from which it started. The first 30 feet of the flue should be of fire brick, but beyond that it can be constructed of sewer pipe. While either hard or soft coal may be used, the best results will be secured with 3- or 4-foot lengths of hard wood. Where the temperature does not drop more than 10 or 12° below zero, a temperature of 40° may be maintained in a house 20 feet wide with one circuit of 12-inch sewer pipe. Care should be taken that the flue in no place is in contact with woodwork, and that there is a gradual rise in the flue from the point where it leaves the furnace to where it enters the chimney. L. R. TAFT.



1002. Rose house, 150 x 20 ft., piped for water.

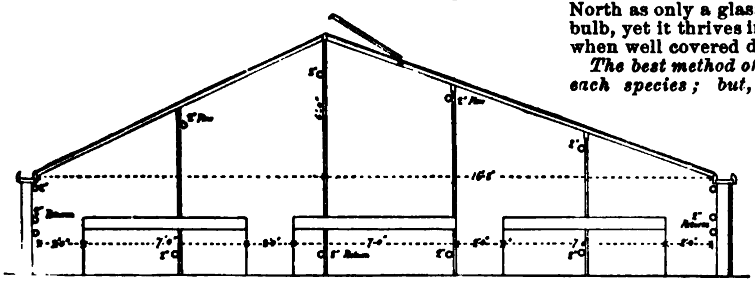
Greenhouse Management.—Persons usually learn to grow plants under glass by rule of thumb. Such knowledge is always essential, but better and quicker results are obtained if underlying truths or principles are learned at the same time. Even if no better results in plant-growing were to be obtained, the learning of principles could never do harm, and it adds immensely to the intellectual satisfaction in the work. There is no American writing which essays to expound the principles of Greenhouse management, although there are excellent manuals giving direct advice for the growing of various classes of plants. The best single recent American book in this line is Taft's "Greenhouse Management," which brings together in one volume concise directions for the growing of the leading kinds of Greenhouse subjects. There are two kinds of principles to apprehend in Greenhouse management,—those relating to the management of the plants themselves, and those dealing primarily with the management of the house.

The first principle to be apprehended in the growing of plants under glass is this: *Each plant has its own season of bloom.* Every good gardener knows the times and seasons of his plants as he knows his alphabet, without knowing that he knows. Yet there are many failures because of lack of this knowledge, particularly among amateurs. The housewife is always asking how to make her wax-plant bloom, without knowing that it would bloom if she would let it alone in winter and let it grow in spring and summer. What we try to accomplish by means of fertilizers, forcing and other special practices may often be accomplished almost without effort if we know the natural season of the plant. Nearly all Greenhouse plants are grown on this principle. We give them conditions as nearly normal to them as possible. We endeavor to accommodate our conditions to the plant, not our plant to the conditions. There are some plants which it is possible to make bloom in abnormal seasons, as roses, carnations, lilies: these we may force (see *Forcing*). But these forcing plants are few compared with the whole number of Greenhouse species. The season of normal activity is the key to the whole problem of growing plants under glass; yet many a young man has served an apprenticeship, or has taken a course in an agricultural college, without learning this principle.

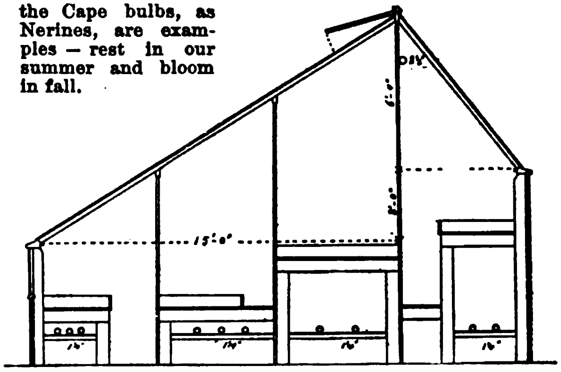
The second principle from the plant side is this: *The greater part of the growth should be made before the plant is expected to bloom.* It is natural for a plant first to grow: then it blooms and makes its fruit. In the great majority of cases, these two great functions do not proceed simultaneously, at least not to their full degree. This principle is admirably illustrated in woody plants. The gardener always impresses upon the apprentice the necessity of securing "well ripened wood" of Azaleas, Camellias, and the like, if he would have good flowers. That is, the plant should have completed one cycle of its life before it begins another. From immature and sappy wood only poor bloom may be expected. This is true to a large degree even in herbaceous plants. The vegetative stage or cycle may be made shorter or longer by smaller or larger pots, but the stage of rapid growth must be well passed before the best bloom is wanted. Fertilizer applied then will go to the production of flowers; but before that time it will go to the production of leaf and wood. The stronger and better the plant in its vegetative stage, the more satisfactory it will be in its blooming stage.

Closely like to the last principle is the law that *checking growth, so long as the plant remains healthy, induces fruitfulness or floriferousness.* If the gardener continues to shift his plants into larger pots, he should not expect the best results in bloom. He shifts from pot to pot until the plant reaches the desired size; then he allows the roots to be confined, and the plant is set into bloom. Over-potting is a serious evil. When the blooming habit is once begun, he may apply liquid manure or other fertilizer if the plant needs it. The rose-grower or the cucumber-grower wants a shallow bench, that the plants may not run too much to vine.

Most plants demand a particular season of inactivity or rest. It is not rest in the sense of recuperation, but it is the habit or custom of the plant. For ages, most plants have been forced to cease their activities because of cold or dry. These habits are so fixed that the plants must be humored when they are grown under glass. Some plants have no such definite seasons, and will grow more or less continuously, but these are the exceptions. Others may rest at almost any time of the year; but most plants have a definite season, and this season must be learned. In general, experience is the only guide as to whether a plant needs rest; but bulbs and tubers and thick rhizomes always signify that the plant was obliged, in its native haunts, to carry itself over an unpropitious season, and that a rest is very necessary, if not absolutely essential, under domestication. Instinctively, we let bulbous plants rest. They usually rest in our winter and bloom in our spring and summer, but some of them —of which some of the Cape bulbs, as Nerines, are examples — rest in our summer and bloom in fall.



1003. Violet house with water heating.



1004. Rose house, 150 x 20 ft., piped for steam.

The natural habitat of the plant is significant to the cultivator: it gives a suggestion of the treatment under which the plant will be likely to thrive. Unconsciously the plant-grower strives to imitate what he conceives to be the conditions, as to temperature, moisture and sunlight, under which the species grows in the wild. We have our tropical, temperate and cool houses. Yet, it must be remembered that the mere geography of a plant's native place does not always indicate what the precise nature of that place is. The plant in question may grow in some unusual site or exposure in its native wilds. In a general way, we expect that a plant coming from the Amazon needs a hothouse; but the details of altitude, exposure, moisture and sunlight must be learned by experience. Again, it is to be said that plants do not always grow where they would, but where they must. Many plants which inhabit swamps thrive well on dry lands.

The upshot of all this is, that the habitat and the zone give the hint: with this beginning, work out the proper treatment. Examples are many in which cultivators have slavishly followed the suggestion given by a plant's nativity, only to meet with partial failure. Because the Dipladenia is Brazilian, it is generally supposed that it needs a hothouse, but it gives best results in a coolhouse. Persons often make a similar mistake in growing the pepino warm, because it is Central and South American. Ixia is generally regarded in the North as only a glasshouse subject because it is a Cape bulb, yet it thrives in the open in parts of New England, when well covered during winter.

The best method of propagation is to be determined for each species; but, as a rule, quicker results and stockier plants are obtained from cuttings than from seeds. Of necessity, most Greenhouse plants are grown from cuttings. In the great majority of cases, the best material for cuttings is the nearly ripe wood. In woody plants, as Camellias and others, the cutting material often may be completely woody. In herbaceous plants, the proper material is stems which have begun to harden. Now and then better results are secured from seeds, even with perennials, as in Grevillea and *Impatiens Sultani.*

Coming, now, to some of the principles which underlie the proper management of the house, it may be said, first of all, that the grower should *attempt to imitate a natural day.* There should be the full complement of continuous sunlight; there should be periodicity in temperature. From the lowest temperature before dawn, there should be a gradual rise to midday or later.

As a rule, the night temperature should be 10–15° Fahr. below the maximum day temperature in the shade. A high night temperature makes the plants soft and tends to bring them to maturity too early. It makes weak stems and flabby flowers. The temperature should change gradually: violent fluctuations are fatal to good results, particularly to plants which are grown at a high temperature.

In Greenhouse cultivation, *every plant is to receive individual care.* In the field, the crop is the unit: there we deal with plants in the aggregate. In the Greenhouse, each plant is to be saved and to receive special care: upon this success depends. There should be no vacant places on the Greenhouse bench; room is too valuable. All this means that every care should be taken to so arrange the house that every plant will have a chance to develop to its utmost perfection. Patient hand labor pays with Greenhouse plants. The work cannot be done by tools or by proxy. Therefore, the gardener becomes skilful.

1005. Range of modern commercial Greenhouses.

Every caution should be taken to *prevent the plants from becoming diseased or from being attacked by insects.* The greater part of insect and fungous troubles in the Greenhouse are the result of carelessness or of mistakes in the growing of the plants. Determine what diseases or pests are likely to attack any plant; discover under what conditions these diseases or pests are likely to thrive: then see that those conditions do not arise. Keep the house sweet and clean. Destroy the affected parts whenever practicable. Then if trouble come, apply the fungicide or the insecticide. Remember that the very protection which is given the plants, in the way of equable conditions, also protects their enemies: therefore, it is better to count on not having the difficulties than on curing them. If diseases or pests have been troublesome, make a complete change of soil or stock before the next season, if practicable. At least once every year there is an opportunity to rid the place of pests. Many gardeners carry their troubles year by year by trying to fight them, when they might succeed by trying to avoid them.

The higher the temperature and the more rapid the growth, the greater the care necessary to insure good results. Plants grown under such conditions are soft and juicy. They are easily injured by every untoward circumstance, particularly by drafts of cold air. Let a draft of cold air fall on cucumbers or rapid-growing roses, and mildew will result in spite of Bordeaux mixture and brimstone.

In dark weather, grow the plants slow. If given too much heat or too much water, they become soft and flabby, and fall prey to mildew, green fly and other disorders. A stocky plant is always desirable, but particularly in the dull weather and short days of midwinter: at that time, take extra precautions in the management of the house.

Watering plants under glass requires more judgment than any other single operation. *Apply water when the plants need it,* is a gardener's rule, but it is difficult to apply because one may not know when they need it. Yet, if the gardener will put the emphasis on the word *need* he will at least be cautioned; novices often apply the advice as if it read, Apply water when the plants will stand it. *Water thoroughly at each application.* Mere dribbling may do more harm than good. Many people water too frequently but not enough. Remember that in benches evaporation takes place from both top and bottom of the soil; and in pots it takes place from all sides. *Water on a rising temperature.* This advice is particularly applicable to warmhouse stuff. Watering is a cooling process. *The foliage should not go into the night wet,* particularly if the plant is soft-growing or is a warmhouse subject. *Water sparingly or not at all when evaporation is slight,* as in dull weather.

In all Greenhouse work, *see that the soil is thoroughly comminuted and that it contains much sand or fiber.* The amount of soil is small: see that it is all usable. In the garden, roots may wander if good soil is not at hand: in pots they cannot. The excessive watering in Greenhouses tends to pack the soil, particularly if the water is applied from a hose. The soil tends to run together or to puddle. Therefore, it should contain little silt or clay. The gardener's practice of adding sand to his Greenhouse soil is thus explained.

Ventilation is employed for the purpose of reducing temperature and of lessening atmospheric moisture. Theoretically, it is employed also for the purpose of introducing chemically fresh air, but with the opening and shutting of doors, and the unavoidable leaks in the house, it is not necessary to give much thought to the introduction of mere fresh air. Ventilating reduces the temperature by letting out warm air and letting in cool air. The air should be admitted in small quantities and at the greatest distance from the plants in order to avoid the ill effects of drafts on the plants. Many small openings are better than a few large ones. Ventilate on a rising temperature.

Most plants require shading in the summer under glass. *Shading is of use in mitigating the heat more than in tempering the light.* A shaded house has more uniform conditions of temperature and moisture. If plants are grown soft and in partial shade, they are likely to be injured if exposed to bright sunlight. Sunscalding is most common in spring, since the plants are not yet inured to bright sunshine and strong sun heat. The burning of plants is due to waves (not bubbles) in the glass. It should be said that, other things being equal, the larger the house the easier is the management of it. It is less subject to fluctuations of temperature and moisture. In the "nesting" of houses, one house protects the other from the weather. A good commercial American Greenhouse plant is shown in Fig. 1005.

L. H. B.

GREENS, CHRISTMAS. The Christmas Greens industry has developed to an enormous extent within a few years. Some twenty years ago, when florists began to use lycopodium, a dozen barrels were all that was used in a single season in many of our lower cities. To-day the output in the United States is probably nearly 200 tons—about 40 car loads.

The materials now used, mentioned in something like their order of commercial importance, are holly, lycopodium (also known as bouquet green, ground pine, club moss, etc.), mistletoe, laurel, and cedar clippings. Other articles of similar utility are wild smilax, hardy ferns, needle pines, outdoor palm leaves, Florida moss, galax leaves and leucothoë sprays: these all come from the South.

Lycopodium is one of the oldest and commonest of decorative materials. During seasons of long continued "Indian summer," a surplus is frequently gathered by careless pickers and dumped on the market. The choicest picked stock being obtainable only through the regular and well established trade channels, such sources are usually the only ones in case of early snow storms, which prevent the gathering of it. Choice stock from eastern Vermont, northern New York and Pennsylvania has been usually handled in large sugar barrels, tied in carefully arranged bunches, weighing perhaps one-half to one pound each. These bunches are packed in the barrels in layers, with roots toward the center. The quantity is always limited and the price 25 to 35 per cent higher than the Wisconsin and Michigan stock. Lycopodium, as handled in the West, comes almost entirely from northern Wisconsin, and is gathered from the north end of Lake Michigan, in the vicinity of Sturgeon Bay, west nearly to St. Paul. The green belt in that state annually moves northward as the country becomes settled and as the woods and swamps are depleted. This plant seems to thrive best in moist, shaded localities, and when plucked out by the roots, as is done when gathering, is not replaced by new growth of its kind. More open situations and drier ground produce lycopodium of a lighter and yellowish color, and consequently of less decorative value. Indians pick the best green, but are unreliable when exact dates must be met. The average season's output from Wisconsin is perhaps 35 car loads, or 150 to 200 tons.

The use of holly in a commercial way has grown from a very small beginning to its present proportions within fifteen years. Until the last six years most of the holly was handled by wholesale seedsmen and florists. Within that time the sale of holly has been taken up by the produce commission houses in large cities, thereby trebling the volume, but reducing the quality. Delaware and Maryland furnish the best stock of what is known as eastern holly, while Tennessee and some other parts of the South ship what is usually an inferior quality. Holly is almost always packed in uniform cases 2 x 2 x 4 ft. Freezing, while packed in cases, damages it but little, provided the holly be allowed to thaw out in a very cool and preferably dark place, where the temperature is not allowed to exceed 45° F. If, however, frozen holly is shipped in warm express cars, the foliage may turn black in a night.

English holly has occasionally been imported into the United States and into Canada, but never satisfactorily commercially. The eastern cities use mistletoe from England and France, brought over in fast steamers. The berries are much larger than those of the American mistletoe, which grows chiefly in Tennessee, Kentucky, Arkansas, Texas and New Mexico. It is usually shipped in crates of about 112 pounds, and the sultry quarters on shipboard often cause the loss of the leaves. The western states use probably not more than 8,000 to 10,000 pounds of American-grown stock from the localities named. It is also shipped in other kinds of packages. Mistletoe is very liable to damage from frost.

Cedar clippings are now but little used during the holiday season, but on other occasions, where open air decorations are desired, they are frequently made into roping or wreaths. Laurel from Maryland and Virginia is mostly used in eastern states.

Wild smilax, in light cases, usually in three sizes, is shipped by express mostly from Alabama and Georgia. It is as liable to injury by freezing as mistletoe, but is not damaged if allowed to thaw out gradually before removal from the case. About $10,000 worth is used annually.

Eight million hardy ferns were recently offered by one wholesale dealer in Christmas Greens. These ferns are largely gathered in Massachusetts and Michigan.

Among the newest and most artistic materials for Christmas decoration are galax leaves and leucothoë sprays, which are here figured and are elsewhere fully described. Galax grows in the mountains from North Carolina to Georgia, and nowhere else in the world.

For further particulars concerning this industry, see American Florist 14:598-600 (1898). For the artistic side of Christmas decoration, see illustrated articles by F. Schuyler Mathews in American Florist 8:484 and 9:493.

J. C. VAUGHAN.

GREENS, EDIBLE, or POT-HERBS. This term Greens is generally applied in America to any Pot-herb, that is to say, to any green herbage which is cooked and served separately from the other principal and secondary dishes of a square meal. The term *Greens* is usually used for the mess of cookery which is brought to the table. It is not so often applied to the plants growing in the garden. In the garden, perhaps, they are herbs—Pot-herbs—though this term is not so much employed as it conveniently might be. Greens are served early in the spring, when the appetite craves anything which tastes like out-of-doors.

All sorts of plants are used as Pot-herbs. Almost anything which shows a succulent growth in the spring is likely to be tried by somebody. Turnip tops, potato leaves, pig-weeds, purslane, and many other apparently impossible herbs, are often impressed into the service. The really good Pot-herbs are comparatively few, however. Probably the best are dandelion, spinach, mustard (various species), endive, chard, beet-top and kale.

The following plants have been more or less used as Pot-herbs:

Buck's-horn Plantain, *Plantago Coronopus.*
California Peppergrass, *Brassica Japonica.*
Cardoon, *Cynara Cardunculus.*
Chard, *Beta vulgaris.*
Chervil, *Anthriscus Cerefolium*
Chicory, *Cichorium Intybus.*
Chinese Amaranth, *Amarantus Gangeticus.*
Chinese Artichoke, *Stachys Sieboldi* (*S. affinis* or *S. tuberifera*).
Chinese Cabbage, *Brassica Pe-Tsai.*
Chinese Cabbage, *Brassica Chinensis.*
Chinese Mustard, *Brassica juncea.*
Chives, *Allium Schoenoprasum.*
Corn Salad, *Valerianella olitoria.*
Cress, *Lepidium sativa.*
  Meadow Cress, *Cardamine pratensis.*
  Pará Cress, *Spilanthes oleracea.*
  Upland Cress, *Barbarea vulgaris* and *præcox.*
  Other so-called Cresses, as *Lepidium Chilense, Lepidium piscidium, Lepidium Virginicum, Senebiera pinnatifida, Nasturtium Indicum, Gynandropsis pentaphylla.*
Dandelion, *Taraxicum officinale.*
Dock, *Rumex*, several species.
Endive, *Cichorium Endivia.*
Globe Artichoke, *Cynara Scolymus.*
Good King Henry, *Chenopodium Bonus-Henricus.*
Goosefoot, *Chenopodium*, mostly *C. album.*
Ice Plant, *Mesembryanthemum crystallinum.*
Italian Corn Salad, *Valerianella eriocarpa.*
Kale, *Brassica oleracea.*
Lettuce, *Lactuca* (especially the wild species, some of which are excellent).
Malabar Nightshade, *Basella alba* and *Basella rubra.*
Mustard, *Brassica* species.
Nasturtiums, *Tropæolums.*
Orach, *Atriplex hortensis.*
Parsley, *Carum Petroselinum.*
Pepper-grass, *Lepidium* species.
Pigweed, *Amarantus* species.
Pokeweed, *Phytolacca decandra.*
Quinoa, *Chenopodium Quinoa.*
Rocket Salad, *Eruca sativa.*
Rosella, *Hibiscus Sabdariffa.*
Salad-Burnet, *Porterium Sanguisorba.*
Sorrels, various, *Oxalis crenata, O. tetraphylla.*
Spinach, *Spinacia oleracea.*
Tuberous-Rooted Chinese Mustard, *Brassica napiformis.*
Turkish Rocket, *Bunias orientalis*
Turnip, *Brassica Rapa.*
Winter Purslane, *Montia perfoliata.*

Culture.—Pot-herbs are wanted at the earliest possible moment in the spring. They are, therefore, often grown in hotbeds, frames, or in greenhouses (see *Spinach, Dandelion, Mustard*, etc.). They must be succulent and tender. It is necessary, on this account, that they be quickly grown in loose, very rich, well-drained soil, with plenty of water. Specific directions for the cultivation of the various plants will be found under the several heads.

F. A. WAUGH.

GREENWEED. *Genista tinctoria.*

GREGÒRIA. See *Douglasia.*

GRENADIN or GRENADINE. A type of Carnation.

GREVÍLLEA (Chas. F. Greville, once vice-president of the Royal Society of England, and a patron of botany). *Proteàceæ.* Trees or shrubs, of nearly 200 species, mostly Australian, of which one is everywhere cult. in this country as a decorative pot-plant. Fls. small, perfect, mostly in pairs in the clusters or racemes, apetalous, the calyx with 4 recurved parts; stamens of 4 sessile anthers borne on the sepals; style 1, long and curved: lvs. alternate, of many forms: fr. a follicle, with 1 or 2 winged seeds.

robústa, Cunn. SILK OAK. Fig. 1006. One of the most popular of all fern-leaved pot-plants, and easily grown from seeds (which are imported in large quantities). When young (from 2-5 ft. high) it makes a most graceful subject. In glasshouses it is not grown to large size, and, therefore, little is known of the great size which it attains in its native forest. According to Von Mueller, it is "indigenous to the subtropical part of

East Australia, rising to 150 feet, of rather rapid growth, and resisting drought to a remarkable degree; hence one of the most eligible trees even for desert culture, though naturally a sylvan plant. The wood is elastic and durable, valued particularly for staves of casks, also for furniture. The richly developed golden yellow trusses of flowers attract honey-sucking birds and bees through several months of the year. The seeds are copiously produced and germinate readily. Rate of growth in Victoria, 20–30 ft. in 20 years. In Ceylon it attained a stem-circumference of 5 ft. in 8 years." In California and S. Fla. it is a valuable lawn tree. When grown in the open, it will stand some frost. As a glasshouse plant it is grown almost wholly from seeds, and is used in its young state; as the plant becomes old, it loses its leaves and becomes ragged below. It thrives in the temperature suited to geraniums or roses, and it stands much hard usage and neglect. It is popular as a window subject. Best results with Grevillea are usually secured by raising a fresh stock every year, from seed sown late in winter or in spring. The following winter or spring they will be in 4–6-in. pots, and will be in their prime. The young plants need frequent repotting to keep them in good condition. *Grevillea robusta* has come to be generally known as a florists' plant within the past ten years. Lvs. twice-pinnatifid, the ultimate divisions narrow and pointed and sometimes lobed, pubescent. B.M. 3184. A.G. 14:115. A.F. 4:413.—In the West Indies the plant is much grown, and it is often trimmed to desired shape. In exposed places the foliage becomes golden in cast.

1006. Grevillea robusta (× ⅙).

There are no other Grevilleas in the Amer. trade, but following are accessible portraits of other species: *G. acanthifòlia*, Cunn. B.M. 2807.—*G. alpéstris*, Meissn. (G. alpina, var., Lindl.). B.M. 5007. R.H. 1887:108. R.B. 23:145.—*G. annulífera*, Muell. B.M. 6687.—*G. arenària*, R. Br. (G. canescens, R.Br.). B.M. 3185.—*G. asplenifòlia*, Knight. B.M. 7070. R.H. 1882, p. 245 (as G. longifolia).—*G. Bánksii*, R.Br. B.M. 5870; G.C. III. 16:15.—*G. Càleyi*, R.Br. B.M. 3133.—*G. canéscens*, R.Br.=G. arenaria.—*G. ericifòlia*, R.Br. B.M. 6361.—*G. fasciculàta*, R.Br. B.M. 6105.—*G. Hilliàna*, Muell. B.M. 7524.—*G. Hookeriàna*, Meissn. B.M. 6879.—*G. intricàta*, Meissn. B.M. 5919.—*G. juniperìna*, R. Br. (G. sulphurea, Cunn.). G.C. II. 26:469.—*G. lineàris*, R.Br. B.M. 2661.—*G. longifòlia*, R.Br.=G. asplenifolia.—*G. macróstylis*, Muell. B.M. 5915.—*G. Preissei*, Meissn. B.M. 5837.—*G. pulchélla*, Meissn. B.M. 5979.—*G. punícea*; R.Br. B.M. 6698.—*G. rosmarinifòlia*, Cunn. B.M. 5971; G.C. II. 5:520.—*G. sericea*, R.Br. (G. dubia, R.Br.). B.M. 3798.—*G. sulphùrea*, Cunn.=G. juniperina.—*G. Thelemanniàna* Hueg. R.H. 1882:456.

L. H.B.

GRÉWIA (Nehemiah Grew, of Coventry, 1628–82, author of a work on anatomy of plants). *Tiliàceæ*. This includes two little known plants slightly cult. in S. Fla. A genus of about 60 species of trees and shrubs in the warmer parts of the Old World, often having stellate pubescence: lvs. entire or serrate, 3–7-nerved: fls. yellow or rarely purple, in axillary, few-fld. cymes or terminal panicles; petals 5, with pits or glands inside at the base; stamens indefinite: drupe 1–4-stoned. **G. Cáffra**, Meissn., from Natal, was int. by Reasoner Bros. in 1891. A bushy plant, with pink star-shaped fls. borne during most of the year. **G. denticulàta**, Wall., from India, was never described. Under this name Reasoner cultivates a plant "resembling a mulberry in growth, which bears enormous quantities of acid drupes, about the size of cranberries; used for pickling."

GRÉYIA (after Sir George Grey, once Governor of Cape Colony). *Sapindàceæ*. A monotypic genus, containing a small tree from Natal, which bears large pikes of pendulous, 5-petaled, scarlet fls., and is cult. outdoors in S. Calif. and abroad under glass in many botanic gardens. In R.H. 1894:252 the plant is shown at its best, with a spike 6 in. long and 2–3 in. wide, containing probably over 100 fls., each three-fourths of an inch across. In France this tree flowered from the end of autumn throughout the winter. The long-exserted stamens with reddish purple anthers make a striking feature. The structure of the fls. is so peculiar that Harvey referred the genus doubtfully to the saxifrage family. In European greenhouses Greyia is a shrub requiring full sunlight, thorough ripening of the wood and a season of rest before flowering. In Natal it flowers in August or September, which is early spring there. Europeans recommend a sandy loam. Prop. by seeds or by cuttings from half-ripened wood.

Sùtherlandi, Hook. & Haw. Small tree, with thick, naked branches: lvs. clustered at the ends of the branches, 2–3 in. long, orbicular, ovate or oblong, deeply cordate at base, toothed; petiole 9–12 lines long; disk cup-shaped, with 10 marginal teeth, each crowned by a peltate gland; stamens 10: ovary laterally 5-lobed, 5-celled; ovules numerous, in 2 series in the inner angle of the cells: fr. capsular, 5-valved: seeds albuminous B.M. 6040. R.H. 1894:252. G.C. II. 19:625. J.H. III. 30:101.

GRIFFÍNIA (after William Griffin, who brought these plants from Brazil). *Amaryllidàceæ*. Seven species of Brazilian bulbs, with distinct foliage and fls. about 2½ in. across, which are more or less tinged with lilac or rose. Like many other genera of the amaryllis family, bulbs of flowering size are too costly for general use. Lvs. usually petioled, and with a very broad blade: perianth tube none or very short; the 3 lower segments narrower than the upper: ovary 3-celled: stigma capitate, rarely 3-fid: umbel 6–15-fld. Griffinia is distinguished from many other genera by its 2 ovules, which are basal and collateral. See Baker, Amaryllideæ.

As there seems to be no recorded American experience with these fine bulbs, the following English experience is taken from W. Watson's article in The Garden 50, p. 209: "Griffinias are called stove plants. They do not always thrive under cultivation, but where they do they are strikingly ornamental. Herbert states that in Brazil they are buried 8 inches deep in strong loam, the scape and leaves rising to the height of 2 feet, whereas in our stoves they rot when potted in strong soil. He recommends light peat and sand for them. But they thrive when planted in fibrous loam three parts, leaf-mold one part, and a good sprinkling of silver sand. The bulbs should be partly buried and the pots carefully drained. During winter the plants rest and require no water. They should be placed on a dry shelf in a warm or intermediate house and kept there until about March, when growth recommences and the flower-spikes push up. The plants ought to be at their best in May, though they do not appear to flower at any definite time under cultivation. They may be made to flower in winter by forcing, but the probable result of this is the sickening of the bulbs. The lvs. are deciduous, new ones being developed along with the flower-spikes, as in the Hippeastrums. The plants require moderate supplies of moisture, both at the root and overhead, and a light position. They do not ripen seeds under cultivation, but may be propagated by means of offsets from the bulbs."

A. *Stigma capitate.*

hyacinthina, Herb. Bulb globose: lvs. 6–9 in. long, 2–3 in. broad, rounded at the base to a channeled petiole as long as the blade: scape 1–2 ft. long: pedicels none or very short: stamens much shorter than the segments. B.R. 2:163 (as *Amaryllis hyacinthina*. Upper segments tinged blue, lower ones nearly white). J.H. III. 31:371. Var. **máxima,** Gn. 50, p. 209, is probably the best garden form. Called "Blue Amaryllis" in some catalogues.

AA. *Stigma distinctly 3-cut.*

Blumenàvia, K. Koch & Bouché. Bulb ovoid: lvs. 4–5 in. long, cuneately narrowed to a petiole, shorter than the blade: scape 6–8 in. long: pedicels ½ in. long: stamens as long as the perianth. B.M. 5666 (veins rose-colored). R.H. 1867:32. Gn. 50:1083 (veined and flushed with rose).

GRINDÈLIA (Prof. Hieronymus Grindel, of Riga and Dorpat). *Compósitæ*. This genus contains 2 plants from which a fluid-extract is obtained that is used externally against poisoning by "poison ivy." They are hardy plants sometimes cult. for their showy yellow fls., which are 1½–2 in. across and borne freely all summer. A genus of about 14 species of American herbs, sometimes shrubby, of coarse habit, mostly natives of the U. S. west of the Mississippi. Lvs. sessile or partly clasping and usually serrate and rigid: heads terminating the branches. The plants often have a sticky balsam, especially the heads before and during flowering, whence they are called "Gum-plants" in California, particularly *G. robusta*, which is the common one. The 2 species described below have roots that are perennial and short-lived, but sometimes annual. These plants are also wholly glabrous, and have firm or rigid leaves.

Grindelias are of the easiest culture, and are prop. by division, cuttings or seed. *G. squarrosa* is hardy in the East: *G. robusta* is sold in Calif. They are best for wild places and trying situations. J. W. Manning says that *G. squarrosa* grows freely in all soils. J. W. Keller writes that it does best in a light, open, moderately rich soil. In California it is common on dry hills. According to John S. Wright, both species grow in salt marshes and on alkaline soil, being indiscriminately gathered for medicinal purposes. The extract is also tonic and sedative, and is used in asthma. The rays are numerous, sometimes 30, about ½ in. long.

squarròsa, Dunal. Shrubby, branched from base, 1–2 ft. high: outer akenes usually squarely truncate and even at summit. B.M. 1706.

robústa, Nutt. GUM-PLANT. Herbaceous: lvs. larger and more rigid: akenes all, or some outer ones, 1-toothed or bordered at the summit. Fls. throughout the Californian winter. Collected stock is offered.

W. M.

GRISELÍNIA (after Franc Griselini, Venetian botanist, middle of eighteenth century). Including *Decostea*. *Cornàceæ*. This includes a tree and a shrub with large, glossy, laurel-like foliage, rarely cult. in the South, and nearly hardy at Washington. A genus of 8 species of trees, shrubs or climbers from New Zealand, Chili and Brazil, with lvs. alternate, often inequal-sided, leathery: fls. minute, in glabrous or pubescent racemes or panicles.

littoràlis, Raoul. Tree, 30 ft. high: lvs. ovate or oblong, wedge-shaped or narrowed into a petiole: veins obscure beneath. New Zealand.

lùcida, Forst. f. Shrub, 10–12 ft. high: lvs. obovate or oblong, very unequal at the base; veins distinct beneath. New Zeal. Not cultivated here. Var. **macrophýlla** (*G. macrophýlla*, Hort.) is a large-leaved form. *G. lucida* is prized in Europe for apartments. Showy. Requires shade and moisture.

GROMWELL. *Lithospermum*.

GROUND CHERRY is *Physalis*; in the Old World *Prunus Chamæcerasus*. **Ground Hemlock** or American Yew, is *Taxus Canadensis*. **Ground Ivy.** *Nepeta Glechoma*. **Ground Laurel.** Old World name for *Epigæa repens*. **Groundnut,** *Apios* and *Panax;* also Old World name for peanut or goober (*Arachis*). **Ground Pine,** *Lycopodium*. **Ground Pink,** *Phlox subulata*.

GROUNDSEL. See *Senecio*. **Groundsel Tree.** *Baccharis halimifolia*.

GRUMICHÀMA. *Eugenia Brasiliensis*.

GRUMÍLEA. All referred to *Psychotria*.

GUAÌACUM (native West Indian name). *Zygophyllàceæ*. Guaiacum is kept in every good drug store, and the tree which produces the resin used in medicine has a hard, heavy wood, used for blocks and pulleys, rulers, etc. It is cult. to a very slight extent in S. Calif. and in tropical Fla. for ornamental value. The genus has 8–10 species of trees or shrubs, mostly tropical American, and all have hard wood and abundant resin: lvs. opposite, abruptly pinnate, leathery: lfts. 2–14, entire: peduncles borne in pairs between the deciduous stipules, 1-fld.: fls. blue or purple: sepals 4–5, deciduous, unequal; petals 4–5, broadly obovate; stamens 8–10, inserted in the short, inconspicuous disk.

officinàle, Linn. Middle-sized or low tree, inhabiting arid plains from the Fla. keys to Venezuela. Lfts. in pairs, evergreen, a quarter to half an inch long.

GUAM, ISLAND OF. See *Ladrones*.

GUAVA (species of *Psidium*, which see). Fig. 1007. The Guava, in its various species, is so easily cultivated and spreads so readily from seeds that it is almost a weed in tropical countries. In Florida and other sections near the tropics it is at home, and succeeds admirably on any soil not too wet. It usually bears in its second year from seed, or after frosting down, hence if a winter passes without seriously damaging the tops, a considerable amount of fruit is produced the succeeding summer and autumn. The strictly tropical species and varieties are the best for all purposes, and make the finest of jelly and preserves. The Cattley and the Chinese are now cultivated in Florida; when dormant they will stand a temperature as low as 22° F. The foliage of these two sorts is very ornamental, being a rich, glossy green, not unlike that of *Camellia Japonica*.

The Guava is most readily propagated from seed, but is quite variable, hybridizing so easily that to secure a certain fine variety recourse must be had to grafting or propagating from cuttings. Grafting is performed after the usual methods. Propagation by cuttings is difficult, but possible, and the best results seem to be had from half-ripened wood, using bottom heat in a frame or house. Large cuttings are occasionally rooted in the open ground, after the same method of rooting figs or willows. If grown from seed, the young plants should

1007. Cattley Guava.

be potted off when very small, and kept growing in pots until wanted for permanent setting in the orchard, as the plants in open ground do not transplant well. Rooted cuttings, of course, should be treated the same as seedling plants as to final handling.

Guavas grow well on any soil, sandy or clayey, rich or poor, dry or moist; but they will not live in a bog. On too rich soil the growth is apt to be rank and the quality of the fruit injured. This fruit tree is as easily grown under sheds as is the pine-apple in Florida, and when thus protected is certain to bear abundantly, even well out of the tropics.

E. N. Reasoner.

GUAZÙMA (namo of Mexican origin). *Sterculiàceæ.* Seven or eight tropical American (one also Javan) trees, with small white, pink or yellow fls. in short-peduncled, axillary cymes. Petals 5, often 2-parted: stamens 10, united into a tube or column, some of them sterile; styles 5: fr. a 5-loculed nut the size of a filbert: lvs. 2-ranked, serrate. Allied to Theobroma, but that genus has a berry-like fr., entire lvs., fascicled or solitary fls., and a different staminal column. **G. ulmifòlia,** Lam., the "Guacima" of Mexico, is offered by Franceschi. It becomes a large tree: branchlets powdery: lvs. ovate to oblong-lanceolate, somewhat pointed, oblique at base, powdery beneath when young but becoming glabrous: nut nearly globular, with 5 furrows. The tree is said to yield medicinal preparations.

GUELDER ROSE. See *Viburnum Opulus.*

GUERNSEY LILY. *Nerine Sarniensis.*

GUEVÌNA. See *Gevuina.*

GUILIÉLMA. See *Bactris.*

GUINEA HEN FLOWER. *Fritillaria Meleagris.*

GUIZÒTIA (after Guizot, the celebrated historian). *Compósitæ.* This genus has 5 species of annual herbs from tropical Africa, one of which has some economic interest from its oil-producing seeds. Neither this nor closely allied genera have much ornamental value. The plants have yellow heads, about 2 in. across, with 8 broad, 3-toothed rays and a leafy outer involucre. Seeds can be obtained by the pound from S. Fla., and they are listed among miscellaneous agricultural seeds in a few of the largest European catalogues. The plant is cult. in India for the oil.

Abyssínica, Cass. (*G. oleifera*, DC. *Verbesina sativa*, Roxb.). Lvs. opposite, lanceolate, clasping, remotely serrate. B.M. 1017.

GUM TREES. See *Eucalyptus* and *Acacia.*

GUNNÈRA (J. Ernst Gunner, 1718–1773, was a Swedish bishop and botanist, and wrote a local flora). *Haloragàceæ.* The little family Haloragaceæ comprises about 100 widely scattered and heterogeneous species in 9 genera. In the northeastern states are the aquatic genera Callitriche, Proserpinaca, Hippuris, Myriophyllum. These comprise small and mostly inconspicuous plants. In the Australian region are the endemic genera Loudonia and Meionectes; and there remain Serpicula, Gunnera, and Haloragis, with very wide and disjointed distributions. Gunnera has perhaps a dozen known species in S. Afr., Abyssinia, Java, Tasmania, Hawaii and S. Amer. In general appearance the Gunneras are wholly unlike our native haloragaceous plants. The lvs. are gigantic and more or less orbicular, radical: fls. perfect or imperfect, small, packed in a great cob-like spike; petals 2 or none; calyx none, or with 2–3 lobes; stamens 1 or 2: ovary 1-loculed, bearing 2 filiform styles: fr. a drupe. They are perennial herbs, and with protection the two following species may be grown even in some of our northern states.

Gunneras are perhaps the noblest of all lawn foliage plants. To produce satisfactory effects, rich, moist ground is indispensable. The plants must never suffer for want of water. Full exposure to sun is advisable, but they should be sheltered from severe winds, else the leaves will be damaged. Ample winter protection should be provided for. A liberal covering of leaves or litter, held in place by brush or branches, will generally keep them from harm. Apply the covering in December and remove early in spring. Prop. by division. Seeds are also employed, and they can now be readily secured.

manicàta, Lind. Stem thick and very short, the titanic crown of lvs. rising from the ground: petioles often as tall as a man, prickly: blades becoming 5 to 10 ft. across, orbicular in general outline, variously lobed, crenate, furrowed and channeled along the great veins: fls. green: spikes dense and tapering, often more than 1 ft. in diam. and 3–4 ft. tall. S. Brazil. I.H. 31:531. Gn. 45, p. 21; 50, p. 455; 54, p. 385. G.C. III. 14:589. G.F. 8:55.—The crown of lvs. sometimes measures from 25–35 ft. across. This is the better species.

Chilénsis, Lam. (*G. scàbra*, Ruiz & Pav.). Not so robust, the lvs. smaller and less spiny, and the fl.-spikes less tall: fls. reddish. R.H. 1862, p. 310; 1894, p. 397. Gn. 49, p. 151. G.C. II. 26:425; III. 8:665.—Longer known in cult. Thrives in drier soil.

L. H. B. and J. B. Keller.

GUTIERRÈZIA (personal name). *Compósitæ.* About 18 species of herbs or subshrubs, often resinous, all American, mostly western N. American. They are much branched from the base, and have narrow, entire lvs. and clusters of small yellow heads.

Euthàmiæ, Torr. & Gray. More or less woody at base, seldom over 1 ft. high: involucre turbinate, 2 lines long: rays and disk-fls. each 3–9: akenes silky-pubescent; pappus of about 9 chaffy scales. N. W. N. Amer.

GUZMÀNIA (A. Guzmann, Spanish naturalist). *Bromeliàceæ.* Includes *Caraguata.* About 70 tropical American Bromeliads, of which several are fairly well known ornamental glasshouse subjects. They closely resemble the erect-growing Tillandsias, but differ in technical characters: fls. in a simple spike-like terminal cluster, tubular, the outer segments or calyx oblong and obtuse, the inner or petals shorter than the tube; anthers inserted on the throat of the tube, and united by their edges around the style. Grown in the warmhouse, along with Billbergia and Tillandsia, which see for culture. Closely allied to Æchmea. Many species are cult. in fanciers' collections in the Old World. For *G. picta*, see *Nidularium.* For *G. Legrelliana*, see *Hohenbergia. G. rosea*, a name which has appeared in the Amer. trade, is probably an Æchmea. Monogr. by Mez, DC. Monogr. Phaner. 9 (1896).

A. *Corolla (or segments) purple or red.*

lingulàta, Mez (*Caraguàta lingulàta*, Lindl. *C. spléndens*, Bouché. *C. lingulàta spléndens*, Hort.). Epiphyte: lvs. many, lanceolate or ensiform, 1½ ft. long, remotely toothed: spike becoming drooping, showily red-bracted: expanded fl. about as long as the long-pointed bracts, the tube yellowish and the limb blue-purple. W. Indies, Cent. Amer., and adjacent S. Amer. B.R. 13:1068. F.S. 11:1091.—Handsome. Var. **cardinàlis,** André (*Caraguàta cardinàlis*, André). Bright scarlet: very showy. Columbia. I.H. 27:374. R.H. 1883:12.

AA. *Corolla (or segments) white.*

tricolor, Ruiz & Pav. (*G. fràgrans*, Hort., at least in part. *G. grándis*, Hort., in part. *G. maculàta*, Hort., in part. *G. monostàchya*, Rusby). Lvs. several to many, broad and more or less recurved, entire on the edges, usually shorter than the stout, erect spike: lower bracts green streaked with black, upper ones red-tinged: corolla white. W. Indies, Cent. Amer., S. Amer. L.B.C. 5:462. F.S. 9:918. B.M. 5220.—Interesting because of its combination of green, red and white. Some, at least, of the horticultural plants which pass as *G. fragrans* belong to *Æchmea eburnea*, Baker (*Canistrum Lindeni*, Mez. *Nidulàrium Lindeni*, Regel). This species is further mentioned under *Nidularium.*

Devansayàna, Morr. (*Caraguàta Devansayàna*, Morr.). Lvs. about 20, narrow linear or ensiform, brown-striped on the back: fls. white, in a dense, oblong spike, the scarlet bracts oval. Equador.

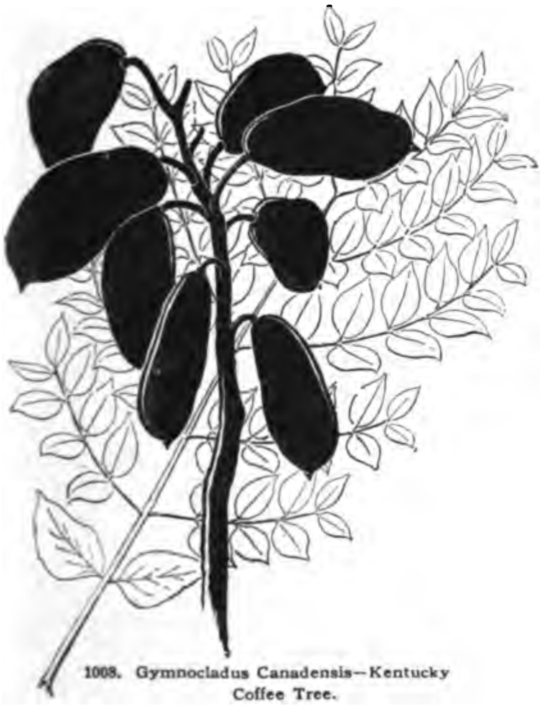
AAA. *Corolla (or segments) yellow.*

Melinònis, Regel (*Caraguàta Melinònis,* Morr.). Lvs. strap-shaped, green above and brown-tinted beneath: fls. yellow, subtended by oblong red bracts. French Guiana.

L. H. B.

GYMNÓCLADUS (Greek, *naked branch;* referring to the naked branches, which in winter are destitute of twigs). *Leguminòsæ.* A genus of 2 species, one of which is a scarce native tree, the Kentucky Coffee Berry, so called because its seeds were used for coffee west of the Alleghanies before and during the Revolutionary War. It is a desirable shade tree for city streets, and is especially interesting in winter. It is a clean, stout tree, bright and graceful in appearance and free from disease, growing from 30–60 ft. high in cultivation, and not leafing out until the middle of May, after the other trees are in full foliage. It is thornless and has compound foliage. Grows with erect divisions, making narrow, pyramidal head. Branchlets very stout and destitute of spray: fls. white, diœcious or polygamous, in terminal racemes: pods long, hanging. Grows naturally in bottom lands and richest soils. May be planted in any soil, but thrives best in deep, rich, or rather humid soil. Prop. by seeds and cuttings.

Canadénsis, Lam. (*G. dióica,* C.Koch). KENTUCKY COFFEE TREE. Fig. 1008. Height in the wild, 75–100 ft.: lvs. large, twice pinnate with 4–7 pairs of partial leaf-stalks, each partial leaf-stalk with 5–13 ovate, acute lfts., except the lowest of 1 lft., 1–3 in. long, standing edgewise. Racemes many-fld. and elongated, nearly white, terminating branches of the season; staminate clusters 3–4 in. long; pistillate 10–12 in., and compact: ovary sessile: pods 6–10 in. long, flat, scythe-shaped, dark reddish brown, hanging unopened all winter. Early summer. S. Ontario to Penn., Tenn., Minn., Neb. and Indian Terr. S.S. 3:123, 124. R.H. 1897, p. 491. B.B. 2:261.



1008. Gymnocladus Canadensis—Kentucky Coffee Tree.

G. Chinénsis, Baill., with smaller, more numerous lfts. and much thicker pods, is not cult.

A. PHELPS WYMAN.

GYMNOGRÁMMA (Greek, *a naked line;* referring to the sori). Also written *Gymnogramme. Polypodiàceæ.* An unnatural aggregate of plants of very dissimilar habit, agreeing in the possession of naked sori, which extend along the veins in various lines. A large number of the species are coated on the under surface with a white or yellow waxy powder, which has given the names of Gold Ferns or Silver Ferns. Two species occur in the West, the "Golden-back" of California, and a species less common from Arizona and other parts of the Southwest. Over 80 species of wide distribution have been included in the genus, which by many is divided into a series of natural genera. The name *Gymnogramma* itself is probably not tenable.

INDEX.

argyrophylla, 9.
aurea, 6.
calomelanos, 8.
chrysophylla, 4.
decomposita, 7.
elegantissima, 2.
hispida, 1.
Laucheana, 4.
magnifica, 8.
Peruviana, 9.
pulchella, 11.
schizophylla, 2.
sulphurea, 5.
Tartarea, 10.
Tatarica, 10.
triangularis, 3.
Wettenhalliana, 11.

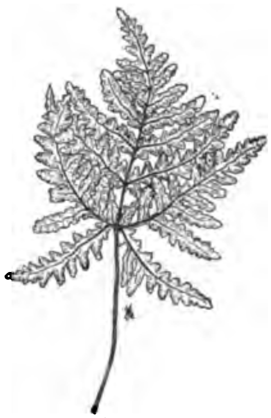
A. *Under surfaces of lvs. not powdery.*

B. *Lvs. pentagonal, hairy on both sides.*

1. **hispida,** Mett. A low plant, 5–8 in. high, with pentagonal, palmate lvs. 1 in. or more either way, densely covered on both sides, but especially below, with strigose hairs. Has been incorrectly referred to *G. Ehrenbergiana.* Tex., Ariz., Mex.—Hardy.

BB. *Lvs. triangular-lanceolate, naked; ultimate segments narrow.*

2. **schizophýlla,** Baker. Lvs. 18–24 in. long, quadripinnatifid, the stalks, rachises and divisions slender, the ultimate segments finely cut. A comparatively recent introduction; very graceful in cultivation. Jamaica. A.G. 18:421. G.F. 2:533. A.F. 10:827. I.H. 31:522. Gn. 48, p. 417. Var. **elegantíssima** (*G. elegantissima,* Hort. W. Bull.), has reddish brown rachises.



1009. Gymnogramma triangularis (×⅓).

AA. *Under surfaces with wax-like powder. (Gold and Silver Ferns.)*

B. *Powder yellow: lvs. about as broad as long.*

3. **triangulàris,** Kaulf. Fig. 1009. Lvs. 2–5 in. wide and long, on stalks 6–12 in. long, dark green above, below deep golden yellow, or occasionally white; lower pinnæ much larger than the others, deltoid; the upper lanceolate. Calif. to B.C. Gn. 48, p. 444.—A white powdered variety with a viscous upper surface and coarser cuttings (var. **viscòsa,** D. C. Eaton) is found in S. Calif.

BB. *Powder yellow: lvs. lanceolate, several times as long as broad.*

C. *Lvs. scarcely more than bipinnate.*

4. **chrysophýlla,** Kaulf. Lvs. 12–18 in. long, with blackish stalks and rachises, the segments slightly pinnatifid at the base: powder golden yellow. W. Indies to Braz. R.H. 1856:201. G.C. III. 23:373.—Often considered a var. of *G. calomelanos.* Var. **Laucheàna** (*G. Laucheàna,* Hort.), has triangular lvs. except in its subvariety gigantea. Gn. 48, p. 437.—By many this species is considered a variety of *G. calomelanos.*

CC. *Lvs. tripinnatifid to quadripinnate.*

5. **sulphùrea,** Desv. Lvs. 6–12 in. long on chestnut-brown stalks, the pinnæ long, tapering, less than 1⅛ in. wide at base, the pinnules compact, with 3–7 divisions; powder sulfur-yellow. W. Indies.

6. **aùrea,** Desv. Lvs. 6–12 in. long, 7–10 in. wide, deltoid; pinnæ deltoid, 2–3 in. wide at base, the ultimate divisions cuneate. Madagascar.—By some this is referred to *G. argentea,* Mett., a similar fern with white powder.

7. **decompósita,** Baker. Lvs. 1½ ft. long, 1 ft. broad, deltoid, quadripinnate or even 5-pinnate; pinnæ close, lanceolate, with the ultimate divisions linear and 1-nerved: powder rather scanty. Andes. F.R. 2:25. G.C. III. 11:365. F.1874, p. 148.

BBB. *Powder white: lvs. lanceolate.*

D. *Segments acute.*

8. **calomélanos,** Kaulf. Stalks and rachises nearly black: lvs. 1–3 ft. long, with lanceolate pinnæ; segments often with a large lobe-like auricle at the upper side of the base. West Indies to Brazil. A.G. 14:303.—The most variable species of the genus. *G. magnifica*, Hort., is probably one of the many garden varieties. Var. **chrysophýlla** is here considered a distinct species. (See No. 4.)

DD. *Segments obtuse, rounded.*

9. **Peruviàna,** Desv. Lvs. 6–12 in. long, 3–5 in. wide, with dark chestnut-brown stalks; pinnæ somewhat regularly pinnatifid on both sides below. Mexico to Peru. By some considered a var. of *G. calomelanos*. Var. **argyrophýlla** (*G. argyrophýlla*, Hort.), is silvery on both sides.

10. **Tartàrea,** Desv. (*G. Tatárica*, Hort.). Lvs. 9–18 in. long, 2–5 in. broad, with closely set pinnæ, tapering gradually to a point; pinnules scarcely divided or cut, mostly merely crenate. Trop. Amer. from Mex. southward.

DDD. *Segments fan-shaped or wedge-shaped.*

11. **pulchélla,** Linden. Lvs. 6–12 in. long, 4 in. wide, the lower pinnæ much the largest; pinnules imbricated; texture rather thin. Venezuela. Var. **Wettenhalliàna,** Moore (*G. Wettenhalliàna*, Hort.), is a garden variety, with pale sulfur-yellow powder.

G. Japónica. See Dictyogramma Japonica.

L. M. UNDERWOOD.

Gold and Silver Ferns are amongst the choicest and most distinct of all ferns in cultivation, by reason of the beautiful golden or silvery powder that covers the backs of the fronds. The best Gold Fern is *G. chrysophylla;* the best Silver Fern is *G. calomelanos*. Unfortunately, however, these fine subjects scarcely thrive anywhere but in a warm conservatory. The finest Gold or Silver Fern will present an unsightly appearance if syringed or watered overhead, as the water carries off the farina. Moreover, many a fine specimen is spoiled by overwatering at the roots in winter time or directly after repotting. The Gold Fern shown on Plate XI, which was considered one of the finest specimens of Gymnogramma ever raised in America, a plant that had been carefully kept for many years, was destroyed one winter by overwatering. In the summer time, when these ferns are growing freely, there is little danger of over-watering, always provided the drainage be thorough. In the winter Gold and Silver Ferns should have a drier atmosphere, and less water will suffice. Plants in small pots should be lowered into a pail of water. Do not soak them again until they show indications of dryness. Large specimens should never be watered with the hose; always use the watering can. A critical time with Gold and Silver Ferns is after repotting, and many promising specimens are ruined as a result of premature watering at this time. When the plants are well established and the roots have taken fresh hold in the new soil they will need more water.

Gold and Silver Ferns like a drier atmosphere than the majority of ferns, particularly in winter. Hence they should not be placed on low benches. Elevate them in some way so that they can get the warmer and drier air of the conservatory. Young specimens should be placed on shelves or brackets near the light. Older plants may be set upon a large inverted pot or fern pan. A plant grown from spores shows its true character early. A year's growth produces fine little ferns, in 2 or 3-in. pots, with fronds 4 or 5 in. long, the young ferns being 2 or 3 in. high. Another year's care will give handsome specimens a foot or more high.

The first thing to do with Gold and Silver Ferns is to give them a special place where they can receive special care. For potting a light mixture is desirable. In the Old World, loam is usually not recommended, but for large specimens the writer has had best success in using 2 parts of fibrous loam, 1 part peat broken or chopped in good sized pieces, and 1 part leaf-mold, with a little sand and some charcoal to keep the soil porous. These ferns can hardly have too much light, and need slight shade only in summer. In winter the night temperature should be 55° to 60°, with a day temperature 5° to 10° higher. Be sure to give these ferns a drier atmosphere and less moisture at the roots in winter than in summer. However, the plants must not be allowed to get too dry.

The writer prefers to grow large specimens in pans rather than in pots, as the roots have more room to spread. Surface rooting can be encouraged by a light mulch of chopped moss, some fine peat and sand. Keep the crown of the plant a little elevated. It is necessary to have plenty of drainage. A good potting soil for young plants consists of 2 parts peat and 1 part sand. Repot in February, before the young growth has started. If repotting is delayed too long the young fronds will be injured.

ROBERT SHORE.

GYMNOPÉTALUM (Greek, *naked petal*). *Cucurbitàceæ.* A genus of 6 species of tropical oriental vines, of which one, *G. Cochinchinense*, is cult. chiefly for its ornamental gourds. It is a tender perennial plant, and is said to have small white fls. borne in late summer and autumn. It is advertised only in the largest seed catalogues, under the name of *Scotanthus tubiflorus*. Scotanthus was formerly thought to be a closely allied genus, differing only in the staminate fls. possessing bracts and 3 bristle-like rudiments of an ovary, while the staminate fls. of Gymnopetalum, by the old definition have no bracts or minute ones, and but 1 rudiment of an ovary. The latest monograph of the Cucurbitaceæ is by Coigneaux in DC. Mon. Phan. vol. 3, 1881. He includes Scotanthus in Gymnopetalum, and distinguishes *G. Cochinchinense* from the 5 other species by the following characters: fls. monœcious, white; calyx teeth long linear-awl-shaped; calyx shortly villous, not tomentose. lvs. ovate, angled or slightly lobed: fr. 10-ribbed.

Cochinchinénse, Kurz (*Scotánthus tubiflòrus*, Naud.). Musk-scented: stem much-branched, slender, grooved, creeping or climbing, 5–7½ ft. long: lvs. about 1½–2½ in. long, 1–2 in. wide: fr. bright red, ovoid, rather acute at the base, produced at the apex into a long point which withers and remains, 2 in. long, more than 1 in. thick.

GYMNÓPTERIS. See *Acrostichum.*

GYMNOSPÒRIA (Greek, *naked seeds;* because in some species the seeds have no false coat, or aril). *Celastràceæ.* This includes a pretty evergreen spiny shrub, cult. in S. Calif., and suitable for hedges. A genus of about 60 species of shrubs or small trees, growing in warm regions: branches often spiny: lvs. alternate. without stipules: fls. in small, forking cymes; sepals, petals and stamens 4–5, the last inserted underneath the disk, which is broad, wavy or lobed; style 2–3-lobed: capsule obovoid or nearly globose: seeds 1–2 in each cell. **G. serràta,** from Himalayas, is cult. at Santa Barbara, Calif., from seeds sent to *F. Franceshi* by the Botanic Garden of Rome.

GYMNOSTÀCHYUM stands as a good genus, but for the trade forms, see *Fittonia.*

GYMNÒTRIX. See *Pennisetum.*

GYNANDRÓPSIS (Greek words: the stamens look as if they were borne on the ovary). *Capparidàceæ.* This genus includes a tender annual plant with 5–7 leaflets, and flowers resembling the spider flower, or Cleome. It is known to the trade at present as a Cleome, but Gynandropsis is distinguished by having a long torus (or receptacle), which is produced into a slender body (or gynophore) which is elongated at the middle, and bears the pistil to which the filaments are united. Cleome has a short torus, which often has an appendix on the back. Stamens about 6 in Gynandropsis: in Cleome 4–6, often 10. Gynandropsis has about 10 species, found in the warmer parts of the world. Leaflets 3–7: fls. white or purplish; sepals deciduous; petals entire or crenulate, obovate, with a slender claw: seeds kidney-shaped or orbicular, compressed, with a wrinkled or tubercled coat. For culture, see *Cleome*.

speciòsa, DC. (*Cleòme speciòsa*, HBK.). Rather velvety towards the top: lfts. 5–7, subserrulate, oblong, acuminate. Mex. W. M.

GYNÈRIUM (Greek, *woolly stigmas*). *Gramineæ*. This genus was until 1897 held to include the Pampas Grass (*Gynerium argenteum*), which has long been considered the finest of all tall, plumy grasses, as also the most important, commercially, of all ornamental grasses. Plumes of Pampas Grass are shipped in large quantities from California to Europe, and are dyed various colors. In nature the plumes are silvery white, with varieties ranging from rose to carmine, violet and purple. They are often 2–3 ft. long. Pampas Grass is grown commercially only in California. The plumes are not collected in South America or shipped therefrom. The plumes of the male plants are much inferior to those of the females, and California growers exercise the greatest care to allow no male plants in the plantation. In this country the plumes are sold chiefly to persons of foreign birth. (See *Everlastings*.) As a border plant, the Pampas Grass is not perfectly hardy in the North, the best substitute for it being *Erianthus Ravennæ*. Horticulturally, Pampas Grass is not to be compared with the Giant Reed (*Arundo Donax*), as the two things represent two different types of beauty. The Arundo is valued for its bold habit, of which the tall, reedy stems are an important feature, while its plumes are wholly incidental, being smaller than those of the Pampas Grass, and often not produced before the northern frosts.

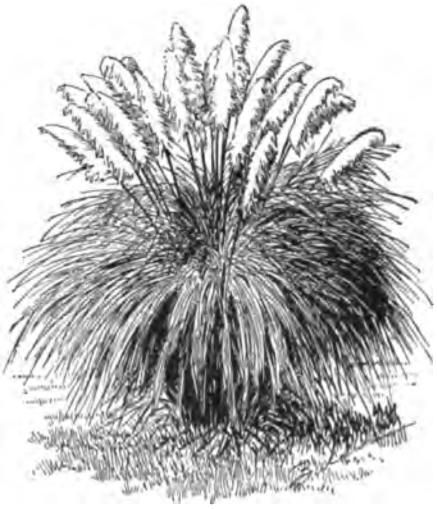
The plumes of Pampas Grass and of Uva Grass (*G. saccharoides*) are both sold in London, and are presumably distinguished in the trade. Uva Grass is too tender to be grown even in southern California. In England Pampas Grass is generally hardy, while Uva Grass is known only to a very few hothouses. Uva Grass is the original species of Gynerium, and is now considered to be the only species in that genus, the Pampas Grass having been removed in 1897 to the new genus Cortaderia. Pampas Grass should henceforth be catalogued by nurserymen as *Cortaderia argentea*. Uva Grass should be tried in southern gardens, as also another plant said by critics to be far more beautiful than either, namely, *Cortaderia jubata*, which is chiefly known to the trade as *Gynerium arcuato-nebulosum*.

Pampas Grass can be grown in sheltered spots as far north as Rochester, N. Y., if well protected in winter. A box well filled with dry leaves, hay or straw, and inverted over the clumps, will generally keep them from harm. Perfect specimens can be obtained only in light, rich soil, with moderate moisture, at least in the early stages of growth. Prop. readily by division in spring, or by seeds, which may produce flowering plants in 2 years.

The popular name "Pampas Grass" is now unchangeable, but the plant does not grow on the pampas or vast grassy plains of South America, but in the mountains. "All the evidence tends to show that it is confined to the neighborhood of water courses and to depressions where there is a constant and sufficient supply of underground water." The manner in which this misleading name became fixed is explained by O. Stapf, of Kew, in his excellent monograph of this group in G.C. III. 22:358, 378, 396 (1897). In this place Stapf gives 5 species of Cortaderia, and another is added in B.M. 7607. In S. America the Pampas Grass and some of its allies are called Cortadero; hence the generic name Cortaderia. Cortaderias are widely distributed in S. America.

Cortadèria argéntea, Stapf (*Gynerium argénteum*, Nees). Pampas Grass. Fig. 1010. Grows in individualized, large, thick tussocks: rhizome very short: culms biennial, 3–6 ft. high, excluding the panicle: lvs. mostly crowded at the base; sheaths increasing in length from the base upwards from 2 in. to 2½ ft., several to many times longer than the internodes: sexual dimorphism of the spikelets slight (apart from the genitalia): spikelets 3–6-fld., the uppermost florets more or less rudimentary. For habit sketches, see R.H. 1890, p. 489. Gng. 5:89. G.C. III. 26:654. J.H. III. 35:43. A.G. 14:323. F.S. 12, p. 179.

None of the following varietal names have botanical rank, but they probably are fairly distinct horticulturally, and so far they have appeared only in connection with the name Gynerium. Var. **monstròsum** is perhaps the most robust, and var. **nànum** (which grows about 3 ft. high), the dwarfest. The others here mentioned are supposed to be the same height as the type. A slender form with narrower foliage is var. **élegans,** with lvs. a fourth of an inch wide and stalks 5–7 ft. high. R.H. 1862, p. 150. It has subvarieties with white striped foliage, var. **elegans-niveolineàtum,** and spotted with white, var. **elegans-niveovittàtum.** The preceding varieties, except where noted, have the height of the type and white plumes. The next four varieties differ from the type in having colored plumes: vars. **ròseum, violàceum, purpùreum** and **carmíneum,** the names indicating the different colors. Varieties with white-striped foliage are **album variegàtum** and **Stenackeri foliis variegàtis.** Varieties with yellow-striped foliage are **aureum variegàtum** and **Wesserlingi variegàtum.** Var. **Roi des Roses** was said by John Saul to have foliage striped with rose, but others describe it as a rosy-plumed variety.



1010. Pampas Grass. (See *Gynerium*.)

When advertised under Cortaderia, these names should all have the feminine endings, as **monstrosa,** etc.

Cortadèria jubàta, Stapf (*Gynèrium jubàtum*, Lem. *G. arcuato-nebulòsum*, Hort.). Differs from Pampas Grass in the rather laxer, more graceful plume, with longer, more flexuous, nodding branches, somewhat smaller spikelets, more delicate glumes, and in the longer, very slender staminodes of the pistillate fls. The plume is lavender-colored, and the plant has been killed by a temperature of 3° F. Grows in a dense tuft, perennial, but with biennial culms: spikelets 3–5-fld. The plume is 1–2 ft. long. B.M. 7607. G.C. III. 26:658. Gn. 55, p. 93. R.H. 1885, p. 200. Gn. 15, p. 179. Int. by Lemoine, of Nancy, France. Probable synonyms are *G. roseum Rendlateri* and *G. argenteum carminatum Rendlateri*. F.S. 20:2075.—Not so well known as the other two species.

Gynerium saccharoides, Humb. & Bonp. Uva Grass. Rhizome creeping: culms perennial, 12–30 ft. high: lvs. rather evenly distributed over the culm, those near the base gradually withering away, leaving the stem naked 4–14 ft. above ground: sheaths nearly equal (except the lowest), about 6 in. long, slightly longer than the internodes: sexual dimorphism of the fls. very conspicuous: spikelets 2-fld. B.M. 7352.—Essentially a more tender plant than the Pampas Grass.

J. B. Keller and W. M.

The growing of Pampas plumes for profit in California has been carried on for over 25 years. Pampas Grass was introduced into the United States about 1848. In the northern states it is frequently planted on the lawn in summer, and upon the approach of cold weather transferred in a tub to a cellar for winter protection. In California, a hill will sometimes attain a height of 20 ft., a diameter as great, and a weight of 2,000 pounds. Such plants would be quite inconvenient for our northern friends to handle in the cellar.

Plants are easily produced from seed, but as the sex and variety are very uncertain, stock is usually increased by dividing the female plants, the plumes of which are much more beautiful than those of the male. The growing of Pampas Grass on a commercial scale dates from 1874, when the difference in sex was discovered.

In 1872 the writer sowed seed which in two years gave several hundred plume-bearing plants. Even then the variations in color and fineness were very marked.

In 1874, it was found that by pulling the immature plumes from the sheaths and exposing them to the hot sun the male plumes would hang heavily like oats, while the female plumes would become fluffy, and light and airy. In November, 1874, samples of the female plumes were sent to Peter Henderson & Co., New York. Three hundred were ordered at once, and the following day instructions were received to double the order and send by express. This was the first lot of good plumes ever sent east from California, and was the beginning of the present Pampas industry. The writer's plantation was increased each year until 1889, when it comprised about 5,000 hills. There were a number of other extensive plantations in the neighborhood of Santa Barbara. The crop of 1889 was estimated at 1,000,000 plumes. The demand has been good, but the prices have never been as high as at the beginning of the industry. The first prices were $200 per 1,000 plumes. The decrease in price was gradual until 1886, when sales were slow at $30 per 1,000 plumes. Some of the growers did not harvest their crops that year, and destroyed their plants. In the fall of 1887 plumes were in demand at $40 per 1,000, and in 1888 they were scarce at $50 and $60 per 1,000. The following spring there was an increase in acreage. Since then the industry has had its ups and downs, and the price has ruled low for several years, the present prices being $13.50 and $14 for first-class, and $8 to $9 for second size.

Pampas Grass should be put on the best valley land, and set 10 by 16 feet apart. Before planting, the ground should be deeply plowed and put in first-class condition. In selecting stock, divide only female plants that produce the finest white plumes. Young hills produce the best plants. From old hills the best plants are obtained around the outside, those in the center of the stool being mostly worthless unless planted in large clumps. Some plumes will be produced the first year after planting. They will not be first-class, but are worth saving. The second year, if well grown, they should produce 80 to 150 plumes to the hill. Not all plantations will yield this much. The third and fourth years there will not be much change in the yield. As a plant gets older the plumes are larger but the yield is less. After 8 or 10 years a quantity of dead matter will have accumulated, and the hills should be trimmed or burned.

The appearance of the plumes is a signal for great activity among those who have large fields. The grass should be so trimmed early in September, before the plumes appear, that each hill will be easy of access. Young plants ripen their plumes two or three weeks earlier than old ones, and some varieties are earlier than others. It requires exercise of judgment to pick the plumes at the proper time. They are generally ready when they are exposed from the husk a few inches and have a fluffy look. It is well to try a few at this stage, and if they cure well at the stem end when dry they are all right, but if they do not become fluffy at the stem end they have been picked too young. If the plume looks dark and seedy at the top when cured, it was too old when picked. Some varieties, especially those producing very long plumes, should be allowed to remain somewhat longer on the plant than those of the short-plumed varieties. By trying a few of each variety, the time of ripening can soon be ascertained. Some varieties are pulled from the husk in the field; others have to be hauled to husking benches, where the husk or sheath is removed. Some planters husk them like corn: others use a knife set in such a way as to split the husk without injuring the plume. When the husk has been split, a quick jerk or strike on the table will extract the plume. The plumes are then taken to the drying ground and evenly spread in long rows. This ground should be made smooth and free from any trash that is liable to adhere to the plumes. Clean stubble ground is the best. The plumes are left on the ground three days and two nights to cure, and are turned and shaken once each day. They are next packed away as broadly and smoothly as possible on shelves in a dry building, where they should lie ten days or two weeks, or until the stems are thoroughly dried, at which time they are ready for market. They are packed in two grades: the first-class, having plumes 26 inches long and over, clear of stem (sometimes as long as 45 inches), is packed in cases that measure three-quarters of a ton and contain 3,000 plumes; second class stock is packed in cases of the same size, the plumes being 17 to 26 inches long clear of stem, and 6,000 in each case. If shipping by express, the writer uses bales of about 2,000 plumes, covered with canvas or burlap and some light strips of wood at the corners. If the plumes are packed smoothly and evenly they will withstand heavy pressure. Careful all-round cultivation is necessary to produce good plumes. About three-quarters of a million plumes are grown at Santa Barbara at the present time.

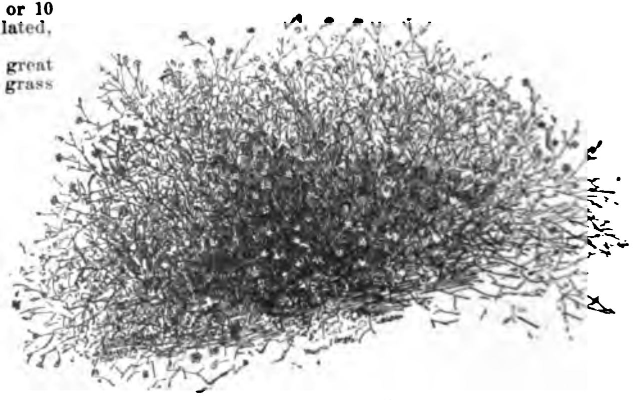
The best market at present is London, the next Hamburg. Berlin, Denmark, New York and Philadelphia take a few. Pampas plumes are colored in London. In America the pure white plumes give the best satisfaction.

JOSEPH SEXTON.

GYNÛRA (name refers to the tailed stigmas). *Compósitæ.* Twenty or more herbs (rarely somewhat shrubby) of tropical Asia, Africa and Australia. Lvs. alternate, entire or lobed, numerous; heads discoid, the florets commonly all fertile, not very showy. The Gynuras are attractive glasshouse herbs, usually requiring a moderately high temperature. Genus allied to Senecio and Cineraria.

aurantiaca, DC. VELVET PLANT. Stout and branchy, 2–3 ft., with almost succulent stems, densely clothed with violet or purple hairs: lvs. large and soft, ovate, jagged-toothed, hairy, short petioled or the upper ones clasping, overlaid with iridescent purple: heads in a terminal cluster, yellow or orange. Java. I.H. 28:436.—One of the handsomest of recent foliage plants. In winter it may be grown in the conservatory or warmhouse, but in the summer it may be bedded out in a warm and protected place. It grows rapidly, and makes a most satisfactory display of colored leafage. It is readily propagated by cuttings in the house, as geraniums are.

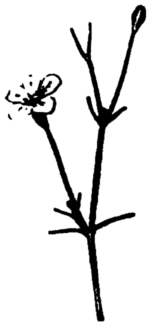
Other species, but not known to be in the Amer. trade, are: *G. auriculàta*, Cass. (G. ovalis, DC. Cacalia ovalis, Ker.).



1011. Gypsophila muralis.

Only slightly villous: lvs. oval, entire or repand, green both sides: fls. yellow, fragrant. China. B.R. 2:101.—*G. bicolor*, DC., 2-3 ft., of looser growth than the above, glabrous: lvs. lance-ovate, somewhat downy, short-petioled, deep-toothed or pinnatifid, green above and purple beneath: fls orange. Moluccas. B.M. 5123.—*G. ovàlis*. DC.=G. auriculata.—*G. sarmentòsa*, DC. Climbing, with purple glabrous stems: lvs. narrow, ovate to lanceolate, acuminate petioled, remotely small-toothed, green and purple-ribbed. Warmhouse plant from Malayan Is. B.M. 7244. L. H. B.

GYPSÓPHILA (*gypsum-loving*, because it likes calcareous soils). *Caryophyllàceæ*. European and Asian herbs, bearing a profusion of small fls., and useful for mist-like effects in mixed borders and as trimming in bouquets. There are perhaps 60 species. Sepals 5, united below, but the calyx naked at the base (not bracted, as in some related genera): petals 5, clawed, very small, usually white: styles 2: pod 4-valved: lvs. small, entire, opposite. Very branchy or spreading, slender herbs, with scant foliage when in bloom. Of easiest culture, in open, rather dry places. They are desirable for rockwork. They make an excellent effect as filling amongst shrubbery; also good for covering unkempt places with a mass of delicate bloom. Hardy.



1012. Gypsophila elegans. Natural size.

A. *Plant annual.*

muràlis, Linn. Fig. 1011. Very diffuse and branchy, mostly with shorter joints than *G. elegans*, of finer appearance: lvs. linear, spurry like: fls. small, rosy; 1–1½ ft. Eu.—Makes a dense little mound when well grown.

élegans, Bieb. Fig. 1012. Repeatedly forked-branched, glabrous: lvs. sessile, the uppermost linear, the lower oblong or spatulate: fls. white or sometimes (*G. ròsea*, Hort.) rosy; 1 ft. Caucasus.—Much cult., and handsome.

AA. *Plant perennial.*

B. *Lvs. short, spatulate: plant pubescent.*

cerastioìdes, D.Don. Low, densely pubescent: lvs. pubescent, the radical ones long-petioled, the others spatulate or obovate, obtuse or nearly so: fls. large (often ¾ in. across), white or lilac, pink-veined. Himalayas. B.M. 6699. Gn. 47, p. 422.—Of creeping habit; excellent for rockwork.

BB. *Lvs. long: plant glabrous or nearly so.*

paniculàta, Linn. BABY'S BREATH. Fig. 1013. Diffuse and rather tall-growing (2–3 ft.), forking: lvs. linear-lanceolate, the largest 3 in. long, but becoming smaller towards the inflorescence, sharp-pointed: fls. white, very numerous: pedicels 2–3 times as long as the calyx. Eu.—A very popular plant, especially for use in the trimming of bouquets. A most graceful subject. Stems stiff and wiry, therefore excellent for cutting. A picture of its use in floral arrangement will be found in A.F. 6:340.

acutifòlia, Fisch. Very like the last, but the plant greener, the lvs. narrower (indistinctly 3-nerved) and the pedicels scarcely longer than the calyx. Caucasus.—*G. paniculata* seems sometimes to be cult. under this name.

Stèveni, Fisch. (*G. glaùca*, Hort.). Lower than *G. paniculata*, glaucous-green: lvs. linear-lanceolate and carinate, mostly radical; fls. rather larger, white, the panicles smaller than those of *G. paniculata;* petals shorter than the calyx. Caucasus.

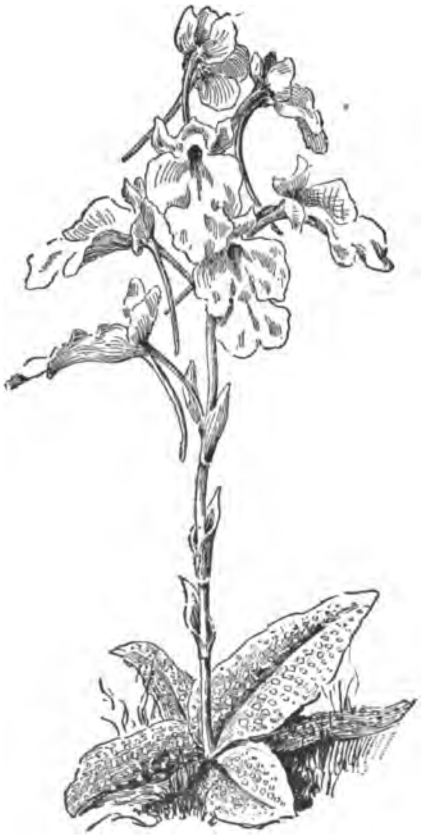
rèpens, Linn. Stems trailing or prostrate, ascending at the ends, not glaucous: lvs. linear, sharp-pointed, glabrous: fls. rather large, white or rose, the petals about twice longer than the sepals and the pedicels usually much longer. Alps and Pyrenees. B.M. 1448.—Best adapted to the rockery. L. H. B.

1013. Gypsophila paniculata.

H

HABENÀRIA (Greek, *a rein* or *strap;* referring to the shape of parts of the flower). *Orchidàceæ*, tribe *Ophrýdeæ*. Rein Orchis. Terrestrial leafy herbs, resembling orchis in habit: tubers usually undivided, rarely lobed: fls. in terminal racemes or spikes, rarely solitary; sepals subequal, free or cohering at base, erect or spreading; petals usually smaller, often 2-lobed; lip spreading or drooping, long- or short-spurred at base, its blade entire or 3–5-fid; column very short, sessile; rostellum usually 1-toothed or lobed; glands naked; anther cells parallel or divergent: capsule ovoid or oblong, erect. The lateral lobes are sometimes fringed, giving the flower a graceful appearance. Species about 400, very widely distributed in temperate and tropical regions.

Few species of Habenaria are of much horticultural importance, especially in this country. Some of the exotic kinds enjoy some favor as stove plants in England, while there are a number of hardy North American species which can be recommended for outdoor cultivation in boggy places. *H. Susannae*, *carnea*, *militaris* and other East Indian species are best grown in a moderately warm house, needing good light and a fair amount of water. It is recommended to repot them after the resting season in a compost of peat, moss, loam and crock dust, with the tuber resting upon the crocked up bottom of the pot and the growing point just beneath the soil. They should then be given a good supply of water until after flowering. These Habenarias are much like Bletia in their requirements.



1014. Habenaria carnea.

The most popular species at present seem to be *H. ciliaris*, *fimbriata* and *psycodes*, but these give a very imperfect conception of the beauties of the genus, although in the opinion of the writer, *H. ciliaris* is the showiest orchid in temperate North America. The native species are procurable through collectors and dealers in native plants: foreign species through Dutch bulb growers; and *H. radiata* through dealers in Japanese plants.

Index of species described below:

bifolia, 29.
blephariglottis, 15.
Bonatea, 19.
bracteata, 24.
carnea, 6.
chlorantha, 20.
ciliaris, 8.
cinnabarina, 10.
conopea, 1.
conopsea, 1
cristata, 9.
dilatata, 35.
elegans, 32.
Elwesii, 18.
fimbriata, 4.
gigantea, 17.
gracilis, 33.
Hookeriana, 30.
Hookerii, 30.
hyperborea, 31.
integra, 7.
lacera, 23.
leucophæa, 22.
leucostachys, 14.
longecalcarata, 16.
militaris, 11.
nivea, 13.
obtusata, 27.
odoratissima, 2.
orbiculata, 28.
peramœna, 3.
psycodes, 5.
pusilla, 11.
radiata, 21.
rhodocheila, 12.
Susannæ, 17.
tridentata, 25.
Unalaschcensis, 34.
virescens, 26.

A. *Fls. purple: lip 3-parted: stems leafy.*

B. *Segments of lip entire: bracts nearly equaling the flowers.*

1. **conópsea**, Benth. (*Gymnadènia conópsea*, R.Br. *G. conópea*, French authors). Deadman's Fingers. Fls. violet-purple to flesh-colored, rarely white, fragrant, medium-sized; spur longer than ovary, sometimes twice as long. June, July. Europe, N. Asia.—There is an *H. conopsea* of Reichenbach dating from 1854, whereas Bentham's dates only from 1880.

2. **odoratíssima**, Franch. (*Gymnadènia odoratissima*. A. Rich.). Fls. intensely red-purple, aromatic, only half as large as in the preceding; spur shorter than ovary. May, June. Europe.

BB. *Segments of lip toothed.*

3. **peramœ̀na**, Gray. Rather tall: fls. large and showy, violet-purple; middle segment of lip 2-lobed. July, Aug. N. J. to Va. and Ill. B.B. 1:466.

BBB. *Segments of lip deeply and copiously fringed.*

4. **fimbriàta**, R. Br. Fls. lilac, rarely white, fragrant; petals laterally toothed. Summer. New Brunswick to Mich. and Mts. of N. C. A.G. 12:152. G.F. 10:483. B.B. 1:466.

5. **psycòdes**, Gray. Three ft. or less high: fls. many, crowded, much smaller than in fimbriata, lilac, rarely white, fragrant. July, Aug. Newfoundland to Minn. and high mountains of N. C. B.B. 1:466.

AA. *Fls. pink throughout: lvs. all radical.*

6. **cárnea**, N. E. Brown. Fig. 1014. Lvs. dull green, spotted with white: fls. few, loosely clustered, light pink, fading nearly white; lip large; spur over 2 in. long. Penang. G.C. III. 10:729. Gn. 47:1005. G.M. 36:642. G.F. 4:487. J.H. III. 33:319. R.B. 21:44.—This species, one of the most beautiful of the genus, is apparently not yet in American trade.

AAA. *Fls. orange.*

B. *Color orange-yellow throughout.*

C. *Lip nearly or quite entire.*

7. **integra**, Spreng. Two ft. or less high, leafy: fls. small, crowded. July. N. J. to La., near the coast. B.B. 1:463.

CC. *Lip fringed or lacerate.*

8. **ciliàris**, R. Br. Yellow Fringed Orchis. Fig. 1015. Fls. crowded, brilliant orange; petals fringed at apex; spur about twice as long as lip; lip long-fringed. Aug. Eastern U. S. B.M. 1668. B.B. 1:464.—A striking species.

9. **cristàta,** R. Br. Smaller: fls. much smaller; petals merely toothed; spur little exceeding the lip. July. N. J. to La. near the coast. B.B. 1:464.

BB. *Color cinnabar-orange, the sepals red-spotted outside.*

10. **cinnabarina,** Rolfe. Small: stem leafy: lip 3 lobed; spur straight, nearly equaling ovary. Madagascar.—Not in Amer. trade.

1015. Habenaria ciliaris, or Yellow Fringed Orchid. (× ¼.)

AAAA. *Fls. with green sepals and petals: lip brilliantly colored.*

11. **militàris,** Reichb. f. (*H. pusilla*, Reichb. f.). Bluish glaucous: fls. numerous; lip scarlet, trifid, midlobe bifid; spur long and very slender, greenish white. Cochin China. R.H. 1888:396. J.H. III. 33:53. G. M. 36:436.—The author says of this fine plant: "No English soldier can boast a jacket of a deeper scarlet than the lip of our plant." Not in Amer. trade.

12. **rhodocheila,** Hance. Nearly related to militaris, but fls. fewer and subcorymbose; petals almost helmet-shaped; lip varying from deep rose-pink to cinnabar and madder; spur dull yellow. China, B.M. 7571.—Not in Amer. trade.

AAAAA. *Fls. white to green or greenish yellow.*

B. *Color pure white.*

C. *Lip entire.*

13. **nívea,** Spreng. Lvs., except 1 or 2 lowest, bract-like: fls. numerous, loosely clustered, small; spur very slender. Summer. Del. to Ala. B.B. 1:462.

14. **leucóstachys,** Wats. Usually tall and stout: lvs. several: fls. many, rather large. Idaho to Ariz., Calif. and Oreg. Mn. 6:81.—Nearly related to *H. dilatata*, but distinguished by its spur greatly exceeding the sepals.

CC. *Lip fringed.*

15. **blephariglóttis,** Poir. Fls. much as in ciliaris, but somewhat smaller; petals slightly erose at apex; spur about 3 times as long as lip. July. Newfoundland to N. C. and Minn. B. B. 1:465. Mn. 8:113.—One of our finest natives.

CCC. *Lip 3-parted.*

16. **longecalcaràta,** A. Rich. Lvs. all radical: fls. 1–3, large, long-stalked; middle lobe of lip narrow, lateral ones broader, unevenly fringed; spur twice as long as ovary, with pedicel. July, Aug. India. B.M. 7228.—Not in Amer. trade.

17. **Susánnæ,** R. Br. (*H. gigantèa*, Don). Stem tall, stout, leafy: fls. 3–5, very large, fragrant; broad, fan-shaped side lobes of lip deeply fringed; midlobe tongue-shaped, entire; spur more than twice as long as ovary and pedicel. India, Malaya, China. B.M. 3374. G.C. III. 16:279. J.H. III. 29:226.—This and the preceding are among the largest-fld. and showiest Habenarias. Not in Amer. trade.

BB. *Color partly or wholly green, or greenish yellow.*

C. *Lip deeply 3-lobed or 3-parted.*

D. *Petals cleft or parted into 2 lobes or segments.*

18. **Élwesii,** Hook. Erect, leafy: fls. few, large, greenish yellow; petals cleft almost to base into long, slender, sickle-shaped, hairy segments; lip smooth, the segments long and slender. India. B.M. 7478.—A remarkable species.

19. **Bonàtea,** Reichb. f. (*Bonàtea speciòsa*, Willd.). Stout, leafy: fls. rather large, light green and white; lobes of lip, especially central one, tubular towards base. S. Afr. G. C. III. 17:743.—Cult. like *Disa grandiflora*.

DD. *Petals not cleft or parted.*

E. *Spur sac-shaped: lobes of lip entire.*

20. **chlorántha,** Spreng. Lvs. clasping: fls. not exceeding bracts, greenish. Mascarene Islands.

EE. *Spur long and slender.*

F. *Middle lobe of lip entire, the others fringed.*

21. **radiàta,** Spreng. Petals exceeding sepals; spur greenish white, about equaling the ovary. Aug., Sept. Japan.

FF. *All lobes of lip deeply fringed.*

22. **leucophæa,** Gray. Four ft. high or less: fls. large, whitish or greenish, fragrant; petals erose; spur exceeding ovary. July. N. Y. to Minn. and Ark. B.B. 1:465.

23. **lácera,** R. Br. RAGGED ORCHIS. Smaller: fls. greenish yellow; spur not equaling ovary. June, July. Nova Scotia to Ga. and Mo. B.B. 1:465.

CC. *Lip merely toothed or slightly lobed: fls. inconspicuous.*

D. *Fls. much shorter than the conspicuous bracts: spur sac-shaped, short.*

24. **bracteàta,** R. Br. Fls. greenish; spur often white. Summer. Northeastern U. S. to B. C., Eu. B.B. 1:463.

DD. *Fls. nearly equaling or exceeding bracts: spur long and slender.*

E. *Lvs. 1–2 near base of stem.*

25. **tridentàta,** Hook. Fls. greenish, loosely clustered; lip wide at apex, 3-toothed; spur incurved. July, Aug. Newfoundland to Minn., Fla. and La. A.G. 12:153. B.B. 1:463.

EE. *Lvs. 3 or more.*

26. **viréscens,** Spreng. Leafy: fls. greenish; lip only slightly exceeding petals, with 2 lateral teeth and a nearly basal wart. July. Range of preceding. B.B. 1:464.

CCC. *Lip entire: fls. inconspicuous.*

D. *Large lvs. all basal.*

E. *Leaf solitary.*

27. **obtusàta,** Richards. Spike loosely-fld.: fls. yellow-green; lip deflexed; spur about equaling lip. Summer. Across B. Amer., south to N. Y. and Col. B.B. 1:461.

EE. *Leaves 2.*

F. *Spur much exceeding ovary.*

28. **orbiculàta,** Torr. Lvs. orbicular, lying on the ground: fls. numerous, loosely clustered, greenish; lip white, obtuse. July, Aug. Across B. Amer. and Minn. to mountains of N. C. B.B. 1:461.

29. **bifòlia,** R. Br. BUTTERFLY ORCHIS. Lvs. oblong: fls. white, with tips of spur and lip greenish, fragrant in the evening. May, June. Eu.

FF. *Spur about equaling ovary.*

30. **Hookeriàna,** Gray (*H. Hoòkeri*, Lindl.). Lvs. oval, obovate or orbicular: fls. greenish yellow; lip acute. Summer. Nova Scotia to N. J. and Iowa. B.B. 1:461.

DD. *Large lvs. several above the base.*

E. *Spike commonly dense.*

31. **hyperbòrea,** R. Br. Fls. greenish; petals, obtuse lip and slender spur all about equally long. Summer. Northern U. S. to Nova Scotia and Alaska. B.B. 1:462.

31. **élegans,** Boland. Large lvs. all on lower part of stem: fls. numerous, small, greenish; sepals 1-nerved, all alike; spur filiform. Vancouver Island to Calif.

EE. *Spike commonly loose.*

F. *Spur short, sac-shaped.*

33. **grácilis,** S. Wats. Three ft. high or less: spike long, many-fld.: fls. greenish; spur about equaling lip and sepals. Ore. and Wash.

FF. *Spur not sac-shaped.*

34. **Unalaschcénsis**, Wats. Fls. white or greenish; sepals, petals and lip about equal; spur slender, barely to nearly twice longer than lip. Summer. Unalaska to Calif. and Utah.—Near *H. elegans*, but more slender, with a longer and more open spike. It is referred by some to the genus Herminium.

35. **dilatàta**, Gray. Fls. greenish white; lip widened or even auricled at base; spur about as long, incurved. Summer. Cooler parts of N. Amer. A.G. 12:153. B.B. 1:462.—More slender and narrower-leaved than *H. hyperborea*.

T. H. Kearney, Jr.

HABERLÈA (after a professor of botany at Pesth, who died in 1831). *Gesneràceæ.* This includes a dainty little hardy herbaceous perennial plant, which is tufted and bears in spring a few scapes 4–6 in. high, with 2–5 nodding, violet-colored, 5-lobed, tubular fls., each about 1 in. long and 1 in. across. Only 1 species is known, and it is found wild only in a few miles of a single valley in Thrace, where it abounds on the southern slope of the Balkans on shaded schistose rocks. Only 4 species of Gesneraceæ are found wild in Europe, and 3 of them are said to be confined each to one spot. The allied genus Ramondia has the same habit and is equally desirable. The corolla of Haberlea has a conspicuous tube, which is thrust out of the calyx nearly ⅛ in., and 5 lobes, 2 of which are much smaller than the others, while in Ramondia the flower seems to be wheel-shaped, with 5 equal petals, because the corolla tube is very short and inconspicuous and the lobes deeply cut.

Haberlea has 4 included didynamous stamens and a bell-shaped calyx. Ramondia has exserted, equal stamens and a wheel-shaped calyx. Haberlea was int. to cult. about 1881 by Leichtlin, and few, if any, of our skilled amateurs know the plant. It is not advertised in America. For culture, see *Ramondia.*

Rhodopénsis, Friv. Clothed everywhere with soft, spreading hairs, except the corolla: lvs. 2–3 in. long, obovate- or ovate-oblong, obtuse, coarsely crenate, thick, leathery, few-nerved: calyx 5-cleft; corolla pale lilac. B.M. 6651.

W. M.

HABRÁNTHUS. Included in *Hippeastrum.*

HABROTHÁMNUS is all referred to Cestrum. *H. fasciculàtus=C. fasciculatum; H. elegans* and *H. coccineus elegans=C. elegans; H. Newelli=C. Newelli.*

HACKBERRY. *Celtis occidentalis.*

HACKMATACK, or **TAMARACK.** *Larix Americana.*

HÆMÁNTHUS (*blood flower*). *Amaryllidàceæ.* Blood Lily. Between 30 and 40 African bulbous plants, of which the greater part are natives of the Cape region. Fls. showy, often numerous, in umbels; perianth straight and erect, with a short, cylindrical tube; segments longer than the tube, narrow, equal; stamens 6, inserted in the throat of the perianth, usually exserted, the anthers versatile; style filiform and erect, on a 3-loculed ovary: fr. berry-like, indehiscent. The fls. are red or white, on a solid scape, which is little, if any, longer than the cluster of root-lvs.: they lack the corona of many amaryllidaceous plants. Monogr. by Baker in Amaryllideæ, 1888; but the S. African species are revised by him more recently in Flora Capensis, vol. 6. See, also, Flora Trop. Africa, vol. 7.

Hæmanthuses, like most Cape bulbs, are summer- and autumn-flowering; or, when started indoors or in frames, blooming in spring or early summer. The fls. often precede the lvs. The foliage is usually large and luxuriant, and the scape is often handsomely colored. The fls. are sometimes as much as 2 in. across, and produced in great ball-like heads nearly or quite a foot through. Yet the species are essentially curiosities in this country. The culture given Nerine suits them well. Their season of growth is usually not more than three or four months, and the remainder of the year they may be laid away in the pots. When growing, give plenty of rather weak liquid manure, keep in an intermediate or warm house, and when in bloom keep them somewhat cooler. Avoid overpotting. Prop. by offsets, which usually form freely; and until they do form, the bulbs will probably not need repotting. Separate the offsets when growth is beginning. In this country they are sometimes flowered in pots plunged in a warm, protected border, blooming in summer and fall. For *H. toxicarius*, see *Buphane disticha.*

A. *Leaves thin or membranaceous.*

B. *Spathes and perianth segments spreading.*

multiflòrus, Martyn (*H. tenuiflòrus*, Herb. *H. Kálbreyeri*, Baker). Bulb globose, 3 in. or less in diam.: lvs. 3–4 on a short, separate stem, the petiole short and sheathing, the oblong blade 6–12 in. long, with 6–8 veins each side of the midrib: scape straight, 1–3 ft. high, green or red-spotted: umbel often 6 in. in diam., containing 30–100 fls., which are usually blood-red, with linear 3-nerved segments twice or more as long as the tube; red filaments long-exserted, bearing prominent yellow anthers. Trop. Africa. Variable. B.M. 961, 1995, 3870. L.B.C. 10:912; 20:1948 (erroneously as *H. puniceus*). F.S. 1:58; 23:2377. I.H. 26:354. Var. **supérbus**, Hort., is an improved brilliant-colored form.

Kátherinæ, Baker. Bulb globose, 2–3 in. in diam.: lvs. 3–5, on a short, separate stem, appearing with the fls., with a short, spotted petiole, the blade oblong, 9–14 in. long and 4–6 in. broad, the lateral veins 8–10: peduncle 1 ft. tall, spotted toward the base: umbel sometimes 9 in. in diam., densely many-fld.: fls. bright red, 2–2½ in. long, the lanceolate reflexing segments little longer than the cylindrical tube; red filaments exserted. S. Afr. B.M. 6778.—Name spelled both *Katherinæ* and *Katharine*, even by Baker; but the former spelling is the original. In cult. the lvs. become "about 3 ft. in length and of a bright pale green color—apple-green, as it is usually called—and the venation is more strongly marked than is usual in *H. multiflorus, H. cinnabarinus* and other allied kinds." Burbidge, Gn. 49, p. 160, with figure.

Lindeni, N. E. Brown. Lvs. 6–8, in 2 ranks, arising from a thick, solid rootstock, nearly or quite evergreen; petioles long, winged; blade 10–12 in. long and 3–5 in. wide, long-ovate, lanceolate or ovate-oblong, acute, the base rounded or subcordate, with a longitudinal fold either side of the midrib: scape 1½ ft. tall, arising from the side of the lvs., flattened on one side, more or less spotted: umbel globular, 6–8 in. in diameter, with 100 or more scarlet fls. opening in succession: fls. 2 in. across, the tube ¾ in. long, the lobes longer and linear-lanceolate and acute. Congo. G.C. III. 8:437; 13:483. I.H. 37:112; 40:172, Fig. 1; 41, p. 18. Gt. 46, p. 217. G.M. 36:220. J.H. III. 28:73.—Handsome.

BB. *Spathes and perianth segments erect or ascending.*

puniceus, Linn. Bulb nearly globular, 2–3 in. in diameter: lvs. 2–4, from the bulb, the petiole one-half the length of the blade, the blade 6–12 in. long and 2–4 in. broad, oblong, strongly undulated, the main veins about 6 on each side the rib: scape 6–15 in. tall, spotted: umbel globose and dense, 3–4 in. in diameter, bearing many scentless, pale scarlet, yellowish red or rarely white fls. 1 in. long: perianth tube cylindrical, shorter than the lanceolate 3-nerved segments: filaments red, 1 in. long. S. Africa. B.M. 1315.

AA. *Lvs. thick and fleshy.*

B. *Bracts and fls. white.*

álbiflos, Jacq. Bulb or tuber compressed sidewise, with thick, 2-ranged scales: lvs. 2–4, appearing with the fls., nearly erect, obtuse, 6–8 in. long and nearly half as broad, narrowed to the base, green and glabrous, but ciliate on the edges: scape less than 1 ft. tall, pale green, bearing a dense, globular umbel 2 in. in diameter: fls. ¾ in long, the linear segments much exceeding the tube. S. Africa. B.M. 1239. L.B.C. 7:602. Var. **pubéscens**, Baker, has lvs. hairy above. L.B.C. 8:702. B.R. 5:382. *H. Clárkei*, Hort., is a hybrid of this species and *H. coccineus.*

BB. *Bracts and fls. red.*

coccineus, Linn. Bulb compressed sidewise, 3 in. in diam., the scales many, thick, 2-ranged: lvs. 2, suberect, lingulate, reaching 2 ft. long and 8 in. broad, narrowed to the base, green and glabrous, not ciliate: scape 6–10 in. tall, compressed, mottled: bracts large and thick, ascending and forming a cup, in which the red fls. are borne: fls. 1 in. long, with linear segments and a short tube. S. Africa. B.M. 1075. L.B.C. 3:240. Var. **coarctàtus**, Baker, has smaller lvs. and shorter bracts. B.R. 3:181.—Odd plants.

tigrinus, Jacq. Lvs. ciliate on the margins, 1 ft. or less long, spotted on the lower part of the back; scape 6 in., red-spotted: umbel dense, 2 in. or less in diam.: bracts shorter than in the last (not over 2 in. long), bright red: fls. 1 in. or less long, with very short tube. S. Africa. B.M. 1705. L. H. B.

HÆMÀRIA (Greek, referring to the blood-red under surface of the lvs.). *Orchidàceæ.* A genus of 4 species of terrestrial orchids, known to the trade chiefly as Goodyera. They are really dwarf stove foliage plants, and are to be cult. like Anœctochilus. In Hæmaria the lower lip is swelled above its base into a wide claw and is provided with a pouch-like sac at base, and a blade of 2 divergent lobes; in Goodyera the blade of the lip is small and not clawed Both genera belong to a large group in which the lip either has no spur or sac, or if the latter is present, it is included between the sepals; while in Anœctochilus the lip has a prominent sac or spur projecting between the lateral sepals.

The leaves of *H. discolor* are green above and red below. It is, however, not nearly so brilliant as *Hæmaria Dawsoniana*, which has the same red color beneath, and is beautifully netted above with red or yellow. In both species a dozen or more small fls., chiefly white, are borne on a densely hairy scape. Alfred Rehder writes that these plants seem much easier to cultivate than Anœctochilus. He has succeeded in growing Anœctochilus only under hand glasses, but has grown Hæmaria without a hand glass in large, shallow pans, with the rhizomes creeping in sphagnum.

A. *Lvs. not netted-veined above.*

discolor, Lindl. (*Goodyèra discolor*, Ker.). Blade of lvs. oblong, 3 in. long. ¾ in. wide. China (Brazil, according to Loddiges). L.B.C. 2:148. B.M. 205. B.R. 4:271. —John Saul's plants had white longitudinal markings.

AA. *Lvs. brilliantly netted-veined above.*

Dawsoniàna, (*G. Dáwsonii*, Boxall. *Anœctochìlus Dawsonidnus*, Low). Blade of lvs. elliptic, 3 in. long, 1¼ in. wide. Burma, Philippines. B. M. 7486 (veins of 2 lvs. blood-red; of the other almost wholly yellow).—John Saul says "golden purple" veins.

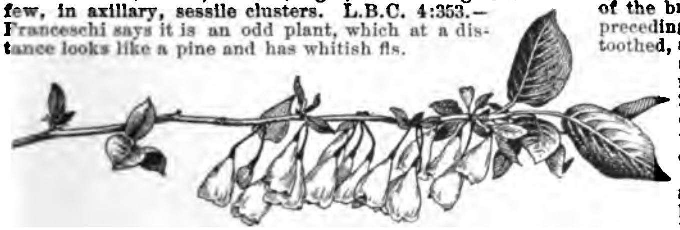
H. Hasselbring.

HAIRBELL or **HAREBELL.** *Campanula rotundifolia.*

HÀKEA (after Baron von Hake, German friend of botany). *Proteàceæ.* A genus of Australian shrubs, slightly cult. indoors abroad and outdoors in S. Calif. The genus is too polymorphous and unimportant to be described at length here. Ninety-five species are fully described in English, with an elaborate key in Flora Australiensis 5:489 (1870).

A. *Length of lvs. 1–2 inches.*

pugioniformis, Cav. Height usually 2–4, rarely 8 ft.: lvs. all entire, terete, smooth, rigid, 1–2 in. long: fls. few, in axillary, sessile clusters. L.B.C. 4:353.—Franceschi says it is an odd plant, which at a distance looks like a pine and has whitish fls.



1016. Halesia tetraptera (×⅓).

AA. *Length of lvs. 4–8 in.*

B. *Nerves many.*

multilineàta, Meissn. Tree or tall shrub: lvs. flat, 6–8 in. long, with many very fine nerves: fls. pink, in an oblong raceme which is 1–3 in. long. G.C. III. 19:85. —Int. in 1899 by Mrs. T. B. Shepherd, who says that there are 5 or more racemes in a bunch.

BB. *Nerves few, 1–3.*

C. *Fls. red, in globular heads.*

laurina, R. Br. Tall shrub, attaining 10 ft.: lvs. 4–6 in. long, 3- or 5-nerved, often sickle-shaped, on long petioles: fls. in a globular head, 1⅜–2 in. thick, from which the numerous showy white stigmas project 1 in. or more in every direction. Blooms in the Californian winter. B.M. 7127. G.C. II. 23:149.—Called Sea Urchin on the Riviera.

CC. *Fls. pink, in long racemes.*

ulicina, R. Br. Lvs. usually linear-lanceolate or linear, pungent, 4–8 in. long, prominently 1–3-nerved beneath: perianth and pedicels glabrous: fr. rarely above ½ in. long, with a short, straight beak.—The foliage resembles the European furze. W. M.

HALÈSIA (Stephen Hale, 1677–1761, author of a famous work on "Vegetable Statics"). Syn., *Mohrodéndron. Styracàceæ.* Silver Bell. Snowdrop Tree. The common Snowdrop Tree (*H. tetráptera*) is a fine, hardy, small-sized tree, which is covered with a bewildering, cloudy mass of small, snowy white flowers, borne about the middle of May, before the foliage of the tree appears. The genus has only 4 species, and is exclusively North American, if we place the Japanese *H. hispida* in the genus Pterostyrax by reason of the subterminal inflorescence and smaller and fleshier fruit. Small trees and shrubs, more or less stellate pubescent: lvs. rather large, membranous, ovate-oblong, acuminate, more or less denticulate, slender-petioled, deciduous, light green: inflorescence lateral: fls. snow-white, bell-shaped, drooping, on slender pedicels, in fascicles or short racemes along the whole length of the branches, borne in the axils of lvs. of the preceding year; calyx obconical, slightly 4–8-toothed, adnate to the 3–4-celled ovary; corolla bell-shaped, epigynous, 4–5 cleft or parted nearly to the base; stamens 8–16: ovary 2–4-celled, 4 ovules in each cell: fr. a drupe, dry, oblong, longitudinally 2–4-winged, tipped with the style and minute calyx teeth.

1017. Halesia tetraptera, var. Meehani.

The common Snowdrop Tree, *H. tetraptera*, is found in woods and along streams, but thrives in almost any good soil. Its habit is round-headed, irregular and somewhat pendulous, rather light and twiggy. It is adapted to shrubberies and lawns in almost any position, but prefers a somewhat sheltered place and a well-drained, rich soil. It is easily transplanted. It often grows in bush form, but may be grown as a tree when cut to one shoot and given ample room. The flowers are rather short-lived, except in var. *Meehani*. Prop. most commonly by layers, also by root-cuttings in spring and autumn; and by seeds, which should be kept constantly moist, as they rarely germinate until the second year if allowed to dry. *H. diptera* is hardy as far north as Philadelphia, but of doubtful hardiness farther north, though it may become acclimatized. Thrives best in a cool, deep loam. Prop. by seeds, which should never be allowed to dry, and by grafting on *H. tetraptera*.

tetráptera, Linn. Fig. 1016. A small tree or shrub 8°–10°, whose fls. resemble those of a snowdrop. Lvs. ovate or ovate-oblong, finely serrate, dark green and glabrous above, pale green and stellate-pubescent below, 2–4 in. long: fls. in lateral clusters of 2–4; corolla 4-lobed, 1 in. long: ovary 4-celled: drupe ellipsoidal, longitudinally 4-winged, 1–1½ in. long. Va. S. and W. B.M. 910. Mn. 5, p. 194. S.S. 6:257. Gng. 2:247. A.G. 14:211; 18:438. M.D.G. 1899:352–3. Var. **Meèhani**, Sargent (*H. Meèhani*, Hort.). Fig. 1017. Habit wholly unlike that of the type, round, bushy and more upright, from a distance looking like an apple tree, 12 ft. high. Has thicker, rugose, dark green lvs., on young plants glandular serrate, and smaller, more numerous fls with short calyx-tubes and cup-shaped corollas, without the narrow base. Seems barren, but is not a hybrid. Growth smaller. G.F. 5:535. Gng. 2:247.

díptera, Ellis. A small tree or shrub from the South not easily distinguished from *H. tetraptera*. The lvs. are larger, ovate, green on both sides, coarsely serrate and downy: fls. white, on long pedicels, in racemes of 2–4, more showy than those of *H. tetraptera;* petals 4, nearly distinct, 1 in. long: ovary 3-celled: drupe with 2 large opposite wings and 2 obsolete. Early June. S.S. 6:259.—Plant not so large as of *H. tetraptera:* lvs. larger and fls. more showy.

H. corymbòsa, Nich.=Pterostyrax corymbosa.—*H. hispida*, Mast.=Pterostyrax hispida.—*H. parviflòra*, Michx. Much like H. tetraptera, but shrubby, with smaller fls. and 2-winged fr. Ga. and Fla.

A. PHELPS WYMAN.

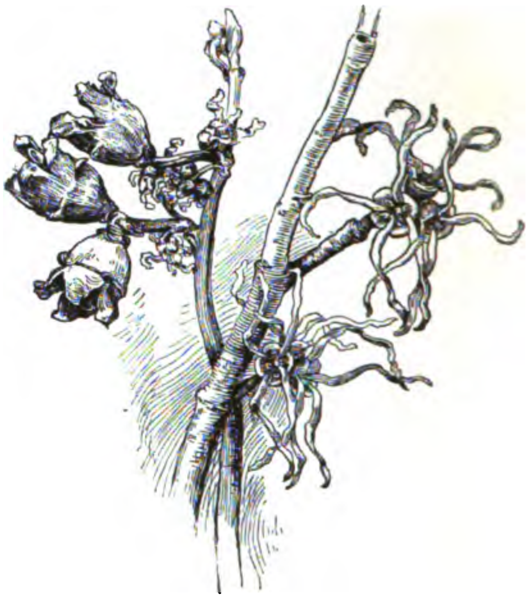
HALIMODÉNDRON (Greek, *salt tree;* referring to the maritime habit of the plant). *Leguminòsæ*. A genus whose sole representative is a hardy deciduous shrub 4–10 ft. high, growing in the dry, barren salt-fields of Siberia. It is characterized by the small, equally pinnate lvs. ending in sharp, stinging spines, and composed of 1–2 pairs of clean lfts., and by the rather large rose-purplish fls., in 2–3-fld. lateral fascicles from the old nodes at the base of the summer shoots, appearing from May–July. The branches are whitish and prickly, with small petiolar spines. In cultivation the shrub is very hardy, enduring both drought and cold, and, while it thrives in sandy soils, it succeeds, also, in saline or alkaline. The rosy fls. and the airiness of the fine lvs. make it very ornamental. It is propagated by seeds, layers and cuttings, or may be grafted upon the common Laburnum, upon *Caragana arborescens*, or *Colutea arborescens*.

argénteum, Fisch. SALT TREE. Lvs compound; lfts. spatulate or long-oval, mucronate, blue-green, more or less pubescent: fls. irregular, papilionaceous; calyx cup-shaped, with 5 short teeth; petals of nearly equal length; standard orbicular, with the sides turned backward; keel obtuse, straight; stamens diadelphous, unequal: ovary stipitate, few-ovuled: style filiform: pod inflated, ovoid, hard, depressed in the seed-bearing portion, 6–7 in. long; seeds oval, sub-compressed. B.M. 1016. R.H. 1876:30, as *H. speciosum*. A. PHELPS WYMAN.

HALLÈRIA (Albrecht von Haller, 1708–1777, Swiss physician and naturalist, and professor at Göttingen). *Scrophulariàceæ*. About 6 species of shrubs from Africa and Madagascar, one of which is cult. indoors abroad and outdoors in S. Calif. **H. lùcida**, Linn., grows 4–6 ft. high, has opposite, ovate, acuminate, serrate lvs., and axillary clusters of about 6 reddish, tubular fls., each about 1 in. long. The fls. are bulged on one side, with 2 short teeth in one lip and 3 in the other, and sometimes yellowish at the base. Stamens 4, didynamous, exserted. B.M. 1744.—Sometimes called African Honeysuckle.

HALOPHÝTUM. See *Hoplophytum*.

HAMAMÈLIS (Greek, *hama*, together, and ***melon***, apple or fruit: fruits and flowers at the same time). *Hamamelidàceæ*. WITCH HAZEL. Hardy ornamental shrubs or small trees, with deciduous, alternate, short-petioled lvs., yellow fls. in axillary clusters, appearing late in fall or early in spring, and with capsular fruits. Valuable on account of their blooming at a time when hardly any other shrub outdoors is in flower; well adapted for shrubberies; of compact, bushy habit and with handsome foliage, turning bright yellow, orange or purple in fall. It thrives best in somewhat moist, peaty and sandy soil. The Japanese species likes a more sunny position than the American, and is less moisture-loving. Prop. by seeds, which do not germinate until the second year, or by layers; rarer kinds also by grafting on seedlings of *H. Virginiana* in spring in the greenhouse. Three closely allied species in eastern N. Amer., China and Jap. Lvs. stipulate, crenate-dentate: fls. in short-peduncled, nodding, axillary, few-fld. clusters, perfect; calyx 4-parted; petals 4, linear, crumpled; stamens 4, very short: fr. a dehiscent, woody, 2-celled capsule, with 2 shining black seeds. The seeds are shot out with considerable force. Occasionally writers spell the common name Wych Hazel, but there seems to be little historical reason for it. Witch, as used in Witch Hazel and Witch Elm, is probably allied to *weak*, referring to a drooping or straggling habit.



1018. Witch Hazel, Hamamelis Virginiana. Showing flowers and fruits. Natural size.

Virginiàna, Linn. Fig. 1018. Shrub or small tree, attaining 25 ft.: lvs. oblique and cordate at the base, obovate, coarsely crenate, pubescent on the veins beneath, 4–6 in. long; petals bright yellow, ½–¾ in. long; calyx dull brownish yellow inside: fr. surrounded by the calyx to one-half. Sept., Oct. Canada to Fla., west to Neb. and Tex. Em. 472. S.S. 5:198. B.M. 6684. L.B.C. 6:598. A.G. 11:657 and 17:771.

Japónica, Sieb. and Zucc. Shrub or small tree, to 30 ft.: lvs. roundish to oblong-ovate or obovate, sinuately crenate, prominently veined beneath, glabrous or pubescent, 2–4 in. long: petals ¾ in. long, yellow; calyx lobes revolute, purplish or yellow inside: fr. only at the base surrounded by the calyx. Feb.–April. Japan.—There are 2 varieties. Var. **arbòrea**, Rehd. (*H. arbòrea*, Mast.). Lvs. larger, usually more roundish and of firmer texture: petals golden yellow; calyx deep purple inside: of more vigorous growth. B.M. 6659. R.H. 1891:472.

G.C. II. 1:187 and 15:205 and III. 9:247. G.M. 34:94. Var. **Zuccariniàna**, Arb. Kew. Lvs. smaller and thinner: petals canary yellow; calyx pale or brownish yellow inside. G.F. 4:257. Gn. 17, p. 251. ALFRED REHDER.

HAMÈLIA (Henry Louis Duhamel du Monceau, 1700–1782, prominent French botanical author). *Rubiaceæ.* This genus contains a tender shrub with large clusters of scarlet-orange fls. much prized in Fla., and recently urged for northern conservatories under the name of "Scarlet Bush." About 13 species of tropical and subtropical American shrubs, glabrous or pubescent: lvs. opposite or in whorls of 3–4, petioled, ovate-oblong, acute at both ends: fls. in terminal, 2-3-forking cymes, yellow, reddish or scarlet, with pedicels short or none; corolla tubular or almost bell-shaped, about 5-ribbed; limb with 5 short lobes; stamens 5: ovary 5-celled: berries small, ovoid, 5-lobed, many-seeded. Hoffmania is distinguished by its 2-3-celled berry.

Hamelia patens, a native of the West Indies and S. Florida, along the coast, a beautiful and almost unknown plant, should become a favorite in greenhouse culture. The lvs. have a purplish hue at some seasons of the year, and the fls. are of a bright orange-red color. In Florida it must surely become a favorite for open-air planting, as it is there rarely killed down by frost, and when it is it sprouts up readily from the root, and blooms the following summer. It is in bloom for many months, and without doubt could be forced at any season. With age it becomes a woody shrub, 5–12 ft. in height. The fls. are succeeded by handsome black berries, which are retained a long while.

A. *Fls. scarlet-orange: berries ovoid, black.*

pàtens, Jacq. Lvs. typically in 3's, rarely 2–5, more or less villous-pubescent: cymes 2–3-forked, disposed in a pedunculate, terminal umbel. B.M. 2533.

AA. *Fls. orange-yellow: berries globular, purple.*

sphærocárpa, Ruiz & Pav. Lvs. in 3's, oblong, hirsute on both sides: cymes disposed in terminal panicles: corolla tubular, distinctly 5-cornered: berries hispid. Woods of Peru. E. N. REASONER and W. M.

HAPLOPÁPPUS is *Aplopappus.*

HAPLOPHÝLLUM. See *Ruta.*

HARBINGER OF SPRING. *Erigenia bulbosa.*

HARDENBÉRGIA (after Franziska, Countess of Hardenberg, sister of Baron Huegel, a well known traveler.) *Leguminòsæ.* Three Australian twining herbs or subshrubs, with long racemes of small fls., ranging from white through pink and rosy purple to violet-blue, often with 1 or 2 green or yellowish spots on the standard. The genus is told from Kennedya by the different habit, smaller, more numerous, differently colored fls., short calyx teeth and by the keel, which in the 2 species described below is much shorter than the wings. Both are cult. abroad under glass by those who are skilled in managing Australian woody plants. The species first mentioned is cult. outdoors in Calif.; the second was once offered by John Saul, of Washington, D. C. These plants can be trained into bush form. Monograph in Flora Australiensis 2:246 (1864).

A. *Leaflets solitary: pods flat, with dry pulp inside.*

monophýlla, Benth. Lfts. usually 2–3, or even 4 in. long, obtuse, varying from broadly cordate-ovate to narrowly lanceolate: fls. less than ½ in. long, in 2's or rarely 3's, as many as 35 in a raceme, and the upper racemes often forming a terminal panicle: pod flat, with dry, pithy pulp inside. B. 2:84. B.M. 263, 2169. L.B.C. 8:758 and 20:1940. B.R. 11:944 and 16:1336. R.H. 1896, p. 431. R.B. 22:169.—Has many synonyms. The fls. range from white through rose and purplish to pure violet, but are never distinctly blue. Var. **álba** is cult.

AA. *Leaflets 3 or 5: pod turgid, without pith or pulp.*

Comptoniàna, Benth. Lfts. 3 or 5, and in the latter case the side ones in 2 opposite pairs, which are not distant as in other 5-leafleted members of the tribe: fls. in pairs or clusters of 3–4 along the racemes. B.R. 4:298, 22:1862 and 26:60. R.H. 1882, p. 344. J.H. III. 30:361.—The fls. are said to have the same size, color and structure as in *H. monophylla*, but in cultivation the blue or violet-blue form has probably been most popular. Var. **álba** is cult.

H. retùsa, Benth., is an anomalous species not cult. All other names in this genus are synonyms of the 2 species described above. W. M.

HARDHACK. *Spiræa tomentosa.*

HARD HEADS. *Centaurea nigra.*

HARDY PLANTS. The word "hardy" covers many distinct ideas. It is used to distinguish plants that can be cultivated outdoors the year round from plants that must be grown under glass part or all of the year. For example, in this Cyclopedia plants are spoken of as hardy as far north as Washington, D. C., New York, Boston or Montreal, meaning that the plants are not killed by the winters at these places. In its widest sense, "hardy" indicates resistance to all kinds of unfavorable conditions. Thus, while all the common geraniums are tender plants, one variety may be hardier than another because it withstands intense heat and drought and general neglect. In general, however, the unqualified word "hardy" indicates that the plant is able to withstand the winter of the given place. See the articles *Border* and *Landscape Gardening.* Smaller divisions of the subject of Hardy Plants are discussed under *Alpine Gardens* (including Rock Gardens) and *Aquatics* (including Bog Plants).

HAREBELL. *Campanula rotundifolia.*

HARICOT (French name for *Phaseolus vulgaris*). Same as Kidney Bean of the English. It is the common garden bean of America, as distinguished from the Windsor or Broad bean, the Lima bean, etc. See *Bean.*

HARÌNA. See *Wallichia.*

HARLEQUIN FLOWERS. *Sparaxis.*

HARPÀLIUM. All referred to *Helianthus.*

HARRIS, JOSEPH (Fig. 1019), agricultural author, was born June 29, 1828, in the village of Shawbury, England, and died at his home at Moreton Farm, near Rochester, N. Y,, Nov. 18, 1892. His father and forefathers for several generations were farmers; it is, therefore, but natural that he should have inherited a keen interest in everything pertaining to rural life. From early youth he showed a remarkable fondness for investigation and experimentation, in the pursuit of which he found gratification by his study of agricultural chemistry with Messrs. Lawes & Gilbert, on their famous experiment farms at Rothamsted. It was during this period that he laid the foundation of his future usefulness in the cause of rational and scientific agriculture and horticulture. In the year 1849 he came to America, and soon become one of the foremost and most reliable writers for the rural press. His "Walks and Talks on the Farm," which appeared in the "Genesee Farmer" in 1864–65, attracted general attention, and in 1866, when the "Genesee Farmer" was purchased by the "American Agriculturist," Mr. Harris joined the editorial staff of this paper and continued his "Walks and Talks" in each number up to 1876. After an intermission of eight years,

1019. Joseph Harris.

he resumed them again until the increasing demands of his seed business upon his time prevented him from continuing them. In all there were 171 chapters. It is to be regretted that these "Walks and Talks" have never been published in book form, as they constitute a decidedly unique feature in our agricultural literature. These articles were written in the form of conversations with the "Deacon," who was his neighbor and one of the oldest farmers in the town, and not, as has often been supposed, a fictitious character. They are narratives of actual experiences on the farm, and talks about things that occupied his thought for the time, and have, therefore, an intensely practical character throughout. He lets the Deacon state that farming is a poor business, and then patiently talks him out of it, and convinces him that the only farming that pays is "high farming," making a garden of the entire farm. He cherished the idea that the intelligent farmer must put his questions to the soil and not to his neighbor, and then have the patience to wait and read the answers when they come. He had an abiding belief in manures and clean land, and in all his writings he earnestly endeavored to impress upon his readers that the real source of fertility must be looked for in the stores of plant-food lying dormant in the soil, and that tillage, underdraining and thorough cultivation are the means by which we develop and render this plant-food available, and that the real basis of success is faith accompanied by good works. His books, "Harris on the Pig," "Talks on Manures," and "The Use of Nitrate of Soda" are all of the same practical stamp. His last book, "Gardening for Young and Old," as its title indicates, is intended as a guide for the boy and his grandfather at the same time, but with the mental reservation that it should be principally for the young folks. Mr. Harris realized the need of more gardening and better gardeners, and had strong faith in the promising future of seed-growing in this country. In the development of these industries he saw bright opportunities for the boys, because they were young and could afford to wait, and especially because they would be more liable to adopt new processes. In this work he makes a strong plea for a more general cultivation of flowers, losing no opportunity to convince the reader that the beauty of flowers elevates the tastes, and their cultivation gives health and pleasure. These and similar sentiments pervade all his writings, and may well serve as a keynote to his life's aim. Whatever work he undertook he did with a full heart and convincing earnestness. His writings and teachings have left an indelible impress upon legions of cultivators of the soil, because he was sound in principle and honest in his convictions. In summing up his life-work, it is safe to assert that no one has done more in this country to dignify rational and profitable agriculture and horticulture than Joseph Harris.

F. M. Hexamer.

HARTWÉGIA (Theodor Hartweg collected in Mexico for the Horticultural Society of London, and found these plants near Vera Cruz). *Orchidàceæ.* A genus of 2 species of tender epiphytic orchids from tropical America, growing about a foot high and bearing purple fls. The genus has the habit of Epidendrum, section Amphiglottis, but differs in having the labellum saccate at the base, in which respect the genus approaches Ponera; however, Ponera has a very different habit. *H. purpurea* was once advertised by John Saul. Rest them in a coolhouse Oct. to Mar. Growing temperature should be 65–90°.

purpùrea, Lind. Lvs. solitary, leathery, ovate-lanceolate, equally terete with the stem, many times shorter than the thread-like peduncle: fls. small, purple; sepals acute, a little larger than the petals; limb of the lip white at the base, callous. Mex.

H. gèmma, Reichb. f. "This is a most lovely gem," wrote Reichenbach, and "much better than its predecessor." Gemma, therefore, does not mean "twin," as sometimes stated. Lvs. solitary, semi-terete, thick, acute, channelled, blotched with blackish violet: fls. amethyst-purple, in a small, 1-branched panicle; odd sepal acute, obtusely strap-shaped; equal sepals oblong-acute. Cent. Amer.

HARVEST BELLS. *Gentiana Pneumonanthe.*

HASSOCK GRASS. Consult *Deschampsia.*

HASTÍNGSIA (S. Clinton Hastings, promoter of Californian botany). *Liliàceæ.* Two bulbous plants of the Pacific slope, with white or greenish fls. in many-fld. panicles or racemes: perianth segments distinct, each obscurely 3-nerved; stamens 6; style short. Hastingsias have strong, nearly naked stems, arising from a scaly bulb: lvs. thick. The two species are offered by collectors, but they are little known in cult. Treatment as for Camassia. **H. álba**, Wats., is 2–3 ft. high: lvs. ⅓in. or less wide: raceme simple or nearly so, 1 ft. long, densely fld., the fls. ¼in. or less long, white or greenish white; stamens equaling the segments. N. Calif. northward. **H. bracteòsa**, Wats. Bracts narrow and nearly equaling the fls., which are larger than in the other, and white; stamens half as long as segments: lvs. longer. Oregon.

L. H. B.

HAW, or HAWTHORN. Consult *Cratægus.*

HAW, BLACK. *Viburnum prunifolium.*

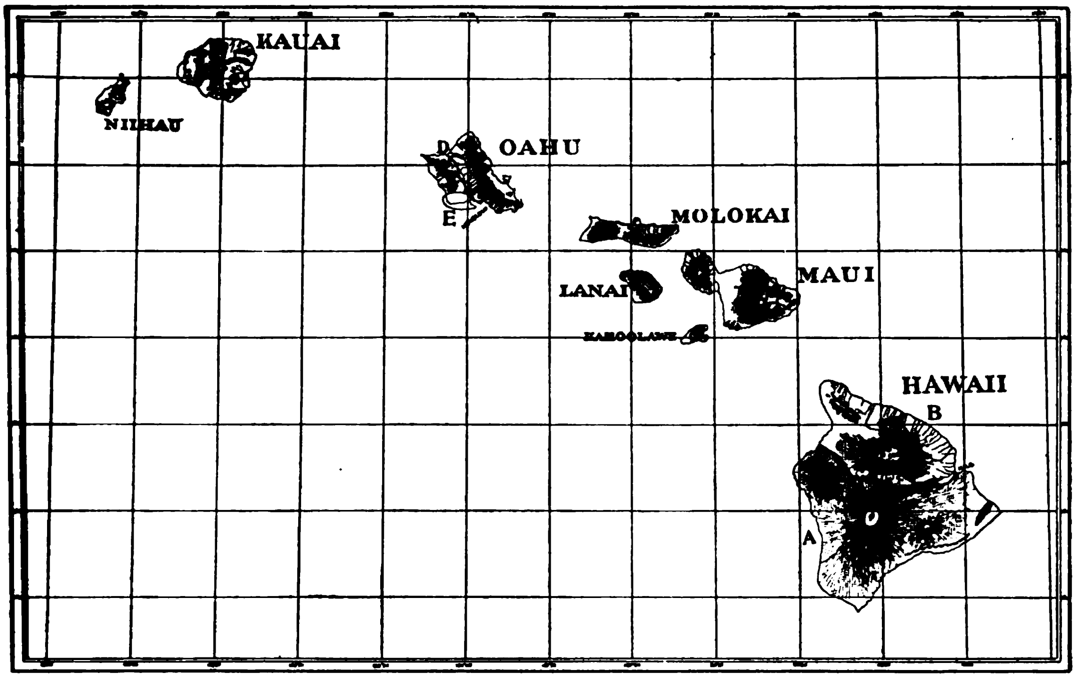
HAWAIIAN ISLANDS, HORTICULTURE IN. Fig. 1020. The group known as the Hawaiian or Sandwich Islands is located about 2,100 miles from San Francisco, in a southwesterly direction. It lies between the parallels 18° 50′ and 23° 5′ north latitude and between the meridians 150° 40′ and 160° 50′ west longitude.

Area.—The five most important islands have an area of about 6,200 square miles, or rather less than that of Massachusetts, and extend about 380 miles from northwest to southeast.

Climates.—It is hardly possible to speak of the climate of Hawaii (as the whole group is sometimes called), for there are so many different climates in this small area. The extent of the rainfall, for example, which forms so important a factor in the horticultural conditions of a country, is decidedly different in different regions and even in localities within a few miles of each other. To understand the climatic conditions, it is necessary to recall that these islands are of volcanic formation, their central parts and the larger part of their area being occupied by rugged and high mountains, with valleys lying between the ranges and narrow plains near the coast. Being in the path of the northeast trade winds, the windward side of the islands receives an abundant rainfall throughout the year, while the southwest shores are comparatively dry. Thus, at Honolulu, on the southwest shore of Oahu, the annual rainfall averages about 38 inches, while that of the city of Hilo, on the windward side of the island of Hawaii, measures 12 feet. Even within a very narrow range, as, for example, the limits of the city of Honolulu, there is great variety of rainfall, certain localities receiving frequent rains throughout the year, while others only two or three miles distant practice irrigation constantly. Some of the great sugar-cane plantations depend wholly upon the natural supply of water, while others could not grow cane at all without their expensive systems of artesian wells and irrigation.

Similarly there is a great variation in the temperature in different parts of this small but important country, but exceedingly slight variations with the changing seasons. The windward side is cooler than that which is sheltered by the mountains, but in no part of the islands is the heat so intense as would be expected from their location within the tropics. Only rarely, in the hottest localities, does the mercury rise to 90° F. Again, the variation in elevation from sea level to many thousand feet gives a like variation in temperature, so that some of the mountains of the largest island are covered with snow during a part of the year. In short, so far as climate is concerned, the Hawaiian Islands offer all that could be asked for great and diversified horticultural industries.

Horticultural Districts.—Only a small percentage of the total area of the country is suitable for cultivation. The tillable portions are, in general, the plains along the coast and the valleys among the mountains. By far the larger part of such lands is now occupied by sugar-cane plantations, which are to be found on every important island of the group. There



1020. Hawaiian Islands. The chief horticultural regions are at A, B, D, E.

are some extensive coffee sections on the island of Hawaii, particularly the district of Kona, whose coffee has established a reputation for peculiar excellence of flavor. There are no large areas devoted to horticulture, but perhaps the most important horticultural regions, at the present time, are on the islands of Hawaii and Oahu. Some of the elevated lands of Maui help to supply the Honolulu market with potatoes. The main horticultural areas are designated on the map by the letters A, B, D, E.

Present Status of Horticulture.—As will be seen from the foregoing statements, horticulture is as yet quite undeveloped. Almost all the scientific effort and investigation in agriculture (using that term in its wider meaning) have been devoted to sugar-cane, for until recently the sugar planters' experiment station has been the only agricultural institution in the islands. There is, however, some considerable variety of horticultural products, and the cultivation of some of these has assumed commercial proportions. Among the latter in the field of pomology is the banana, of which there are many different varieties in the country. Some of these grow wild in the woods, as do also oranges and limes. Bananas and a few pineapples are the only fruits grown to any extent for export; though the people are awakening to the horticultural possibilities, and some are planting other fruits. The export of bananas for the year 1898 amounted to 76,000 bunches, and the home consumption, though no record is taken of it, would doubtless be found considerably greater. These are raised chiefly by the Chinese, but there are also white men in the business who, by their superior skill, produce a finer fruit.

The oranges are seedlings almost without exception, but some of these are, in the writer's opinion, well worthy of propagation, having a flavor which many prefer to that of the fruit imported from California. The island of Hawaii produces most of the home-grown oranges in the market, but the gardens of all the islands have their orange trees.

Grapes for the Honolulu market are grown for the most part by the Portuguese within the limits of the city. The Isabella and the Concord are the only two varieties that have succeeded thus far, but there can be no doubt that this is due merely to the lack of scientific and persistent effort. Peaches thus far have failed, and possibly for the same reason. They, however, do not take any decided season of rest. Grapes are pruned twice per year frequently—in fact usually—and are made to produce two crops per year. Among the other fruits which are much esteemed are the cocoanut, papaya (*Carica Papaya*), alligator pear (*Persea gratissima*), mango, fig, guava, lime, and other tropical and subtropical fruits. Apples have been grown on the higher elevations of Hawaii, but plums, pears and apricots have not yet been made to succeed to any extent.

Vegetable gardening is conducted chiefly by the Chinese, who grow most of the commoner and more easily managed vegetables. These are marketed from house to house in baskets, balanced on a pole over the shoulder. The taro (Colocasia), which when manufactured into "poi" forms the chief food of the natives, is also now grown chiefly by the Chinese.

In floriculture, asters and carnations and a few other flowers are produced by the Portuguese and natives in the vicinity of Honolulu for sale in the flower market, which consists of the open sidewalk lined with Hawaiian men and women sitting against the buildings sleeping or smoking or making "leis." These "leis" (lays) are solid wreaths of flowers, which, according to Hawaiian custom, are thrown about the shoulders of friends departing on a voyage. This is mentioned here since more flowers are probably sold in this form than in any other way. Many plants, such as carnations, violets, pansies and the like, when grown on the lower lands, are cultivated in boxes raised some distance from the ground, for the ground temperature seems to be rather too high to produce the best results. Hawaii is not quite so much a "land of flowers" to-day as in years gone by, for in recent years a most devastating pest, commonly known as the Japanese beetle, has driven the rose and other plants almost completely out of cultivation. This, which is the most important insect enemy to horticulture, has been combated with its natural enemies in the way of fungi, and, though still a serious pest, its numbers are not so great as formerly.

Landscape gardening may be mentioned, since it bears so close a relation to horticulture. Much money has been spent in the "improvement" of home grounds, and some architectural gardening is to be found, but naturalistic landscape gardening is, as yet, in its infancy in the islands, though nature furnishes so many excellent types.

POSSIBILITIES OF HORTICULTURE.—There can be no doubt that the climates and the qualities of the soils are such as to give to this country a very brilliant future in the production of varied and superior horticultural products. The amount of available land, however, is limited, since the larger tillable tracts are already used in the production of sugar-cane, and will probably remain so occupied. Still there are a good many small areas admirably adapted to horticulture.

Then, too, the matter of market is one which must be considered, since for all articles which cannot be shipped on a six days' voyage, the cultivator is limited at present to but one city of about 30,000 inhabitants and another good-sized town. Again, the highly developed horticulture of California lies between Hawaii and the great American markets. These home towns, however, are likely to double and treble their present population during the next few years, and while there are to-day many tons of fruit and vegetables imported from California on every cold-storage steamer which arrives, there does not seem to be immediate cause for alarm regarding the market. An outlet for fruits and vegetables during the winter season is hoped to be found in California, and a colony of American settlers is now developing this trade.

Many minor industries are being tried, such as the cultivation of the vanilla bean, various fiber plants, the castor oil bean, and the like, and doubtless some of these will prove valuable additions to the agriculture of the country. The future of Hawaiian horticulture is not an easy subject upon which to prophesy at the present time, but one upon which many greatly interested in the country's welfare are now thinking. A government experiment station is greatly needed to aid in the solution of some problems connected with the subject.

J. E. HIGGINS.

HAWKWEED. *Hieracium.* Various species of *Crepis* are known as HAWKSBEARD.

HAWÓRTHIA (A. H. Haworth, an English botanist of the beginning of the century, who wrote much and well on succulents). *Liliàceæ*, tribe *Aloìneæ*. Acaulescent or short-stemmed succulents: lvs. mostly rather small, crowded in short or less commonly elongated rosettes: fls. white, rosy-striped, with somewhat irregular spreading limb, the style and stamens included. Cape region. Cultivation and propagation as for Aloe, Gasteria and Apicra, to which the genus is closely related. Latest monograph, Baker, in Flora Capensis, vol. 6, 1896–7.

INDEX.

albicans, 25.
altilinea, 23.
arachnoides, 24.
aristata, 23.
asperula, 19.
attenuata, 7.
coarctata, 6.
concava, 16.
cuspidata, 20.
cymbæfolia, 16.
cymbiformis, 16.
expansa, 3.
fasciata, 8.
herbacea, 22.
hybrida, 13.
lævigata, 25.
lævis, 25.
limpida, 23.
major, 9.
marginata, 25.
Margaritifera, 9.
mirabilis, 17.
mucronata, 23.
pumila, 22.
Radula, 12.
Radula asperior, 10.
recurva, 15.
Reinwardtii, 5.
Reinwardtii viridis, 6.
reticulata, 22.
retusa, 19.
rigida, 3.
rugosa, 10.
scabra, 4.
subulata, 11.
tessellata, 14.
tortuosa, 2.
triangularis, 1.
turgida, 21.
viscosa, 1.

A. *Foliage on an elongated stem. (Aspect of Apicra.)*

B. *Lvs. concave, never coarsely white-dotted.*

C. *Arrangement of lvs. 3-ranked.*

1. **viscòsa**, Haw. (*Alòe viscòsa*, Linn. *A. triangulàris*, Lam. *Apìcra viscòsa*, Willd.). Lvs. broad and short, densely imbricated, appressed, with spreading apex, minutely scabrous or viscidly punctate. B.M. 814.—In the type the leaf rows are vertical, but several marked varieties occur, in some of which they are prominently spirally twisted.

2. **tortuòsa**, Haw. (*Alòe tortuòsa*, Haw.). Lvs. more elongate, less crowded, not spreading at apex, in strongly twisted rows, scabrous. B.M. 1337 (as *Aloe rigida*).—Varies into several named forms.

CC. *Arrangement of lvs. many-ranked: stem shorter.*

3. **rigida**, Haw. (*H. expánsa*, Haw. *Alòe rigida*, Ker-Gawl. *A. expánsa*, Haw.). Lvs. spreading or recurved, somewhat attenuate, scabrous on the back. L. B. C. 15:1430.

4. **scàbra**, Haw. (*Alòe scàbra*, Schult. f.). Lvs. suberect in a shorter rosette than usual, thick and rather obtuse, nearly plane above, both faces rugose-scabrous.

BB. *Lvs. mostly biconvex, white-dotted.*

5. **Reinwardtii**, Haw. (*Alòe Reinwardtii*, Salm-Dyck). Fig. 1022. Lvs. erect, often plano-convex, inflexed at apex, very acute, somewhat veined beneath, the back or both faces with numerous elevated white tubercles in more or less evident rows.

6. **coarctàta**, Haw. (*H. Reinwardtii viridis*, *Alòe coarctàta*, Schult. f.). Lvs. thicker, clearer green and more succulent, strongly biconvex, the back with a few scattered, scarcely elevated whitish dots.

1021. Hawaiian vegetation. Showing the Royal Palm as it grows in Honolulu.

AA. *Foliage in a compact rosette.*

B. *Margin of lvs. not horny.*

C. *Shape lvs. lanceolate. (Aspect somewhat of Aloe humilis.)*

D. *The lvs. coarsely white-tuberculate.*

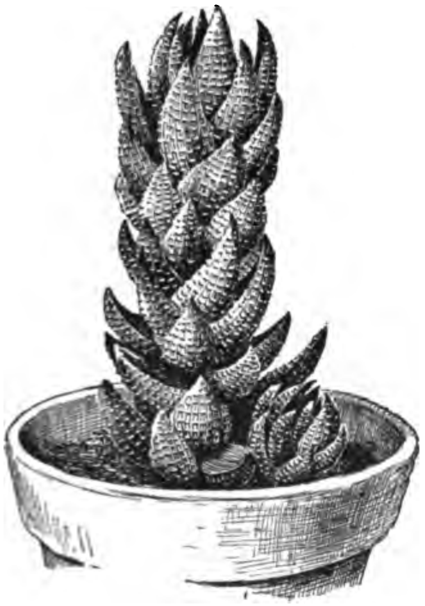
7. **attenuàta**, Haw. (*Alòe attenuàta*, Haw. *Apìcra attenuàta*, Willd.). Lvs. thick, attenuate, rigidly spreading, rather concavo-convex, scabrous or often white-dotted above, the back with the white tubercles mostly in transverse rows. B.M. 1345 (as *Aloe Radula*).

8. **fasciàta**, Haw. (*Alòe fasciàta*, Salm-Dyck. *Apìcra fasciàta*, Willd.). Lvs. more turgid, suberect, merely acute, not scabrous, the large white dorsal tubercles confluent in rather distant transverse bands.

9. **margaritifera,** Haw. (*H. màjor*, Duval. *Alòe margaritifera*, Burm.). Lvs. turgid, spreading, merely acute, both faces with scattered coarse white tubercles, which often turn green on the upper surface. P.G. 57. Varies into several named forms.

DD. *The lvs. less conspicuously white-tuberculate.*

10. **rugòsa,** Bak. (*Alòe rugòsa*, Salm-Dyck. *H. Rádula aspèrior*). Lvs. long attenuate, spreading, plano-convex, both faces with irregularly placed, rather coarse greenish tubercles.



1022. Haworthia Reinwardtii.

11. **subulàta,** Bak. (*Alòe subulàta*, Salm-Dyck). Like the preceding, but the scattered or rugosely confluent tubercles very small, whitish.

12. **Rádula,** Haw. (*Alòe Rádula*, Jacq. *Apìcra Rádula*, Willd.). Lvs. shorter, the white tubercles finer. Cape.

13. **hýbrida,** Haw. Lvs. short, more turgid, the upper face somewhat rugose, the lower with scattered green tubercles. Cape?

CC. *Shape of lvs. ovate to deltoid, succulent, not tuberculate, spreading, the rosette often somewhat elongated.*

14. **tessellàta,** Haw. (*Alòe tessellàta*, Schult. f.). Lvs. acute or acuminate, setosely denticulate, scabrous beneath, the smooth upper surface with pale lines anastomosing in squares.

15. **recúrva,** Haw. (*Alòe recúrva*, Haw. *Apìcra recúrva*, Willd.). Lvs. entire, scabrous beneath, the smooth upper surface longitudinally pale striate. B.M. 1353.

16. **cymbifórmis,** Haw. (*H. concàva*, Haw. *Alòe cymbifórmis*, Haw. *A. cymbæfòlia*, Schrad. *Apìcra cymbæfòlia*, Willd.). Lvs. entire, smooth, rather obtuse, longitudinally striate. B.M. 802.

CCC. *Shape of lvs. cuneately prismatic, pellucid.*

D. *The lvs. erect, obliquely truncate, with deltoid, pale-striate apex.*

17. **mirábilis,** Haw. (*Alòe mirábilis*, Haw. *Apìcra mirábilis*, Willd.). Lvs. ciliate-denticulate on margin and keel, sparingly tuberculate beneath. B.M. 1354.

18. **aspérula,** Haw. (*Alòe aspérula*, Schult. f.). Lvs. entire, finely scabrous.

19. **retùsa,** Haw. (*Alòe retùsa*, Linn. *Apìcra retùsa*, Willd. *Catevàla retùsa*, Medic.). Lvs. entire, smooth. B.M. 455.

DD. *The lvs. erecto-spreading, pointed, smooth.*

20. **cuspidàta,** Haw. (*Alòe cuspidàta*, Schult. f.). Lvs. stout, rather concave, entire, nearly erect, the setulose apex obscurely longitudinally or reticulately striate and sometimes truncate, but very obliquely so.

21. **túrgida,** Haw. (*Alòe túrgida*, Schult. f.). Lvs. small, spreading, very turgid, acute, entire, longitudinally striate.

22. **reticulàta,** Haw. (*Alòe reticulàta*, Haw. *A. pùmila*, Linn. *A. herbàcea*, DC. *A. arachnoìdes reticulàta*. *Apìcra reticulàta*, Willd.). Lvs. as in the last, or slightly ciliate on the angles, the striations anastomosing. B.M. 1315. L.B.C. 14:1354.

23. **altilínea,** Haw. (*H. mucronàta*, *H. límpida* and *H. aristàta*, Haw. *Alòe altilínea*, Schult. f.). Lvs. entire, aristately pointed, longitudinally striate.

24. **arachnoìdes,** Haw. (*Alòe arachnoìdea*, Mill. *Apìcra arachnoìdes*, Willd. *Catevàla arachnoìdea*, Medic.). Lvs. more flattened-triquetrous, aristately pointed, the angles ciliate-toothed. B.M. 756.

BB. *Margin and keel of lvs. horny-bordered.*

25. **álbicans,** Haw. (*H. lævis*, Haw. *Alòe lævigàta*, Schult. *A. álbicans*, Haw. *A. marginàta*, Lam. *Apìcra álbicans*, Willd.). Lvs. broad, 3-sided, acute, entire, smooth or with a few dorsal tubercles, white-bordered. B.M. 1452.

WILLIAM TRELEASE.

HAWTHORN. See *Cratægus.*

HAWTHORN, EAST INDIAN. *Raphiolepis ovata.*

HAZÁRDIA (Barclay Hazard, Californian botanist). *Compósitæ.* This includes a small Californian subshrub, with silvery leaves and peculiar, not pretty, heads of fls., borne in August. It is suitable for rockeries and bedding out, but there are better woolly-leaved plants in cult. The genus has about 4 species of stout, tomentose, deciduous shrubs of the islands off the coast of Calif.: heads white-tomentose, numerous, in large cymose panicles, which terminate the branches; rays 5–8, neutral, very short, ligulate or irregularly 5-toothed or lobed, pale yellow changing to brownish purple. In 1887 E. L. Greene made this new genus, remarking that it differs from Diplostephium mainly in habit, the paucity, reduced size, and different color of its rays. It also lacks the tuft of hairs characteristic of the style-tips of Corethrogyne.

detónsa, E. L. Greene. (*Corethrógyne detónsa*, Greene). Lvs. of firm texture, 3–5 in. long, obovate-oblong, coarsely serrate; upper surface of older lvs. partly divested of the white tomentum which covers all other parts of the plant.

F. FRANCESCHI and W. M.

HAZEL. See *Corylus.* **Chilean Hazel is** *Gevuina Avellana.*

HEAL-ALL. *Brunella.*

HEART'S EASE. Old English name for Pansy, *Viola tricolor.*

HEARTSEED or **BALLOON VINE.** *Cardiospermum.*

HEATH, HEATHER. The common Heather of Old World literature is a hardy plant, *Calluna vulgaris.* The greenhouse Heaths are from the Cape of Good Hope and Europe, and belong to the genus *Erica.* For St. Dabeoc's Heath, see *Dabœcia.*

HEATING is discussed under *Greenhouse Heating. Construction* and *Management.*

HEBECLÍNIUM. All referred to *Eupatorium.*

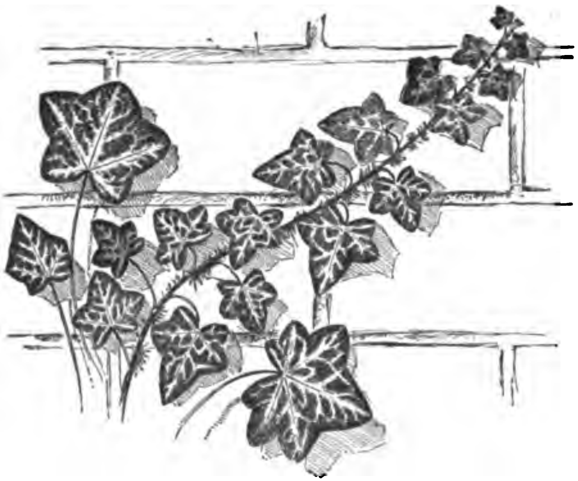
HÉCHTIA (J. G. H. Hecht, who died in 1837). *Bromeliàceæ.* A genus of 15 species of Mexican succulent plants, one of which is perhaps cult. in a very few fanciers' collections of tender plants for its dense rosettes of recurved spiny lvs., which are purple above from the middle to the tip and silvery beneath. The genus is distinguished by having diœcious fls. The fls. have no decorative value, being one-third of an inch across, white, in small sessile, axillary, yellow-bracted heads, borne at intervals of an inch or so on a very slender scape 2 ft. long. Give perforated pots and high temperature. Mon. by C. Mez in DC. Mon. Phan. 9:543–551 (1896).

glomeràta, Zucc. (*H. Ghièsbrechtii*, Lem.). Lvs. 10–18 in. long, rigid, leathery, 9–12 lines wide at base, narrowed gradually to the sharp-pointed apex: bracts sheathing, acuminate: corolla 3-lobed nearly to the base; stamens 6: ovary 3-celled. B.M. 5842. I.H. 10:378.—Soil of chopped moss, old manure and charcoal.

HEDEÒMA (Greek, *sweet smell*). *Labiàtæ*. AMERICAN PENNYROYAL. This is a plant of no ornamental value, but the seeds are offered by our nurserymen to those who cultivate the plant for its medicinal oil, which is commonly sold in drug stores. It is claimed to be offensive to mosquitoes, and the plant can be easily naturalized in dry, sandy spots. It is common in woods and along roads. The genus has about 16 species, all American. The Pennyroyal of the Old World is *Mentha Pulegium*, sometimes cult. for its lvs. and tops, which are used as culinary herbs.

pulegioides, Pers. AMERICAN PENNYROYAL. Annual, 6–18 in. high: stem very slender, much branched, pubescent: lvs. opposite, ovate to oblong-obovate, sparingly serrate in the upper portion, mostly obtuse at the apex and narrowed at the base, ½–1½ in. long: fls. in axillary clusters; corolla purple, 2-lipped, the lower one with 3 large lobes. July–Sep. B.B. 3:106.

HÉDERA (ancient Latin name of the Ivy). *Araliàceæ*. IVY. Ornamental evergreen climbing shrubs, with alternate, entire or palmately 3–5-lobed, long-petioled lvs., inconspicuous greenish fls. in terminal, peduncled umbels, appearing in fall, and black, rarely yellow, red or whitish berries. Some small-lvd. forms may be grown North if protected during the winter, but most of the larger-lvd. and variegated forms are too tender north of the middle states. The Ivy is a very valuable plant for covering walls, rocks, trunks of trees and trellis-work, and sometimes climbs very high. It may also be used for covering walls in cool greenhouses, for screens in drawing-rooms and for hanging baskets. It is a popular window-garden plant, enduring many uncongenial conditions and thriving without bright sunlight. In shady places under trees it makes a handsome evergreen carpet, and is also often used for borders of shrubberies or flower beds. It grows in almost any soil, but best in a somewhat moist and rich one, and in shaded positions. The climbing or creeping branches do not flower; fls. are produced on erect, bushy branches, appearing on old, high-climbing plants only. Prop. by cuttings of half-ripened wood at any time of the year in the greenhouse or in frames, or, in more temperate regions, in the open ground in fall; gentle bottom heat will hasten the development of roots considerably; also increased by layers and by seeds. The slow-growing forms, especially the shrubby ones, are often grafted on cuttings of strong-growing varieties. Two species in Eu., N. Afr. and Asia. Fls. perfect; calyx 5-toothed; petals and stamens 5: ovary 5-celled: fr. a 3–5-seeded berry. Many Araliads have been described formerly as species of Hedera which are now referred to other genera. A good popular monograph is Shirley Hibberd's "The Ivy: A Monograph, comprising the history, uses, characteristics, and affinities of the plant, and a descriptive list of all the garden Ivies in cultivation." London, 1872.



1023. Hedera Helix (× ⅓).
Form with white-ribbed leaves.

Hèlix, Linn. IVY. ENGLISH IVY. Fig. 1023. High climbing or creeping: lvs. usually 3–5-lobed, dark green above, pale or yellowish green beneath,—those of the flowering branches entire, generally ovate: calyx with minute teeth; calyx, pedicels and tips of young branches covered with grayish white stellate hairs: fr. black, sometimes yellow. Eu., Canaries, N. Afr., Asia.—A very variable species, of which more than 60 varieties are cult. in European gardens. Some of the most remarkable are the following: Var. **Algeriénsis**, Hort. Lvs. roundish or broadly ovate, entire or slightly 3-lobed, rather large, bright green; a variegated form has the lvs. edged yellowish white. Var. **arboréscens**, Loud. (*H. arbòrea*, Hort.). Not climbing, forming an erect, low shrub: lvs. ovate to elliptic, entire. This variety is gained by using flowering branches for propagation. There are also some variegated forms, as Silver Queen, with silvery variegated lvs. Var. **aurantiaca**, André. Lvs. rather small, ovate or triangular-ovate, entire or 3-lobed, the middle lobe often with few coarse teeth, greyish green: fr. orange-red. R.H. 1884:84. Var. **Canariénsis**, DC. Lvs. large, roundish ovate, entire or slightly 3-lobed, bright or yellowish green, to 8 in. broad, those of flowering branches often broader than long. Canaries. Tender. Var. **Càvendishi**, Hort. (var. *marginàta minor*, Hort.). Slow-growing, with rather small dull green lvs., edged creamy white, striped red or pink in fall. Var. **chrysocárpa**, Ten. (*H. chrysocárpa*, Walsh. *H. poetàrum*, Bertol.). Lvs. rather small, usually 3-lobed, grayish green: fr. yellow. Var. **conglomeràta**, Hort. Slow-growing: lvs. crowded, small, entire or 3-lobed, undulate. R.H. 1890, p. 163. Var. **crenàta**, Hort. (*H. vitifòlia* and *H. digitàta nòva*, Hort.). Similar to var. digitata, but lobes shorter and broader, crenate at the margin, light green. Var. **deltoidea**, Hort. Lvs. rather small, bluntly deltoid, almost entire, blackish green, changing to dull purplish bronze in fall. Var. **digitàta**, Loud. Lvs. rather small, deeply palmately lobed, with narrow lobes and prolonged middle lobe. M.D.G. 1897:229. S.H. 2:237. Var. **Donerailénsis**, Hort. Lvs. small, usually 3-lobed, with rather short, spreading lateral lobes: of compact growth. Var. **grácilis**, Hort. Lvs. rather small, with broad, short lobes, dull green, bronzy in fall. Var. **Hibérnica**, Koehne (*H. Scótica*, Hort.). Lvs. large, with short and broad lobes. Var. **lobàta màjor**, Hort. Similar to the preceding, but lvs. somewhat smaller, more deeply lobed and lobes narrower. Var. **maculàta**, Hort. (*H. latifòlia maculàta*, Hort.). Similar to var. Hibernica: lvs. spotted and striped yellowish white. Var. **Maderénsis variegàta**, Hort. Similar to var. Canariensis: lvs. not or slightly lobed, edged white. Tender. G.C. II. 15:657. Var. **marginàta**, Hort. Lvs. broadly triangular-ovate, irregularly bordered yellowish white, striped red or pink in fall: of somewhat slow growth. Var. **marginàta rùbra**, Hort. (vars. *tricolor*, *elegantissima*, *Cullisi*, Hort.). Like the preceding, but edges of lvs. becoming red in fall. Var. **marmoràta**, Hort. Similar to var. Hibernica, but lvs. irregularly blotched yellowish white. Var. **palmàta**, Hort. Similar to var. digitata, but lobes broader, and middle lobe not much prolonged. Var. **rhómbea**, Arb. Kew. (*H. rhómbea*, Sieb. & Zucc.). Lvs. rather small, generally broadly ovate, entire or slightly lobed, those of flowering branches elliptic or rhombic-ovate, narrowed toward the base. Japan. Var. **rhómbea-variegàta**, Hort. (*H. submarginàta*, Hibberd. *H. Japónica variegàta*, Hort. *H. Japónica argéntea*, Hort.). Lvs. like those of the preceding, but with narrow white margins. Var. **sagittifòlia**, Hort. Lvs. rather small, with triangular middle lobe and short, blunt lateral lobes.

dull dark green. Var. **variegàta**, Hort. Lvs. lighter green, edged and blotched yellowish white.

Cólchica, C. Koch (*H. Rægneriàna*, Hort. *H. coriàcea*, Hibberd). High climbing, but usually less high than the common Ivy. Lvs large, broadly ovate, cordate, almost entire, rarely slightly 3-lobed, bright green, of firm texture, those of flowering branches generally oblong-ovate: calyx lobes triangular-ovate, conspicuous; calyx, pedicels and tips of young branches coated with golden yellow scales: fr. black. W. Asia. Var. **dentàta**, Hibberd (*H. dentàta*, Hort.). Lvs. with remote small teeth, of somewhat thinner texture. G.M. 30: 388. Var. **purpùrea**, Hibberd. Lvs. purplish.

ALFRED REHDER.

HEDGES. Living green fences are used for two distinct purposes—defense and ornament. Ornamental Hedges may be rendered defensive by stretching tightly 2 or 3 strands of barbed wire through the center of the Hedge. So far, no plant has yet been tested that meets all the requirements of the farmer for a truly impassable barrier, although the Osage orange (*Maclura aurantiaca*) possesses more recommendable features than any other hardy tree. This tree, however, is not hardy in the northernmost states. Next to this, perhaps, ranks the honey locust (*Gleditschia triacanthos*), with many warm admirers and advocates. The hawthorn of Europe (*Cratægus Oxyacantha*) may not be planted in this country with any chance of success, owing to fungous enemies, and all of the large-sized thorny shrubs fail in important characters. A perfect thorn Hedge requires unremitting care, and must conform to an established rule, the most important being entire freedom from weeds and a systematic pruning. The preparation of the soil for a Hedge consists in thoroughly plowing and cultivating an area 6 feet wide and the length the Hedge is proposed to extend. If this space should be fertilized and cropped the year previous to planting, vegetation will be greatly accelerated. The plants must be shortened, both top and root, and set 9 inches apart in a single row. The double row, as formerly advised by some growers, is now practically obsolete, and justly so, being difficult to cultivate and preserve free from weeds. A trench or furrow is opened through the center of the cultivated strip of a sufficient depth to admit the roots without bending In setting, the soil must be made firm with the aid of a rammer, a practice unexcelled for aiding growth, and, indeed, preserving plant-life after removal. Pruning is simply an annual necessity from the first, excepting when the Hedge is intended to be plashed, and even in such cases, after the laying process, pruning must never be omitted during summer. This work is greatly accelerated and consequently cheapened by shearing when the plants are young and tender, say during the month of July. As to the best outline, a plain triangle, or what may be more sightly, the curvilinear or Gothic arch, is desirable, and a flat top is to be discouraged, as a body of snow lodged on the latter invariably injures the symmetry and beauty of any Hedge. The ornamental Hedge proper may be either evergreen or deciduous, and yet in the so-called California privet (*Ligustrum ovalifolium*) are united, to a certain extent, both conditions. Taking into consideration its almost faultless character for the purpose, we may assign it a prominent position at the head of the list.

Among strictly evergreen plants, the Norway spruce (*Picea excelsa*) succeeds most satisfactorily. For a combination of cheapness and general utility, the American arborvitæ (*Thuja occidentalis*) may be placed next, although for decided beauty nothing can supplant the common hemlock (*Tsuga Canadensis*). The number of available deciduous trees and shrubs suitable for Hedging is so extensive that to specify even a few is unnecessary. Flowering shrubs may, however, claim preference, and such attractive species as *Cydonia Japonica*, *Deutzia scabra*, some of the spireas, viburnums, etc., may be employed with good effect. Species of Berberis are occasionally used with marked success, especially the purple-leaved variety, although rather formal in character. The most serious annoyance to the Hedge grower is the presence of unwelcome woody vines, such as poison ivy (*Rhus Toxicodendron*), Japan evergreen honeysuckle (*Lonicera Japonica*), etc., and the only remedy is to persistently remove them by hand as soon as discovered. The attacks of insects may be treated similarly to those which injure our trees and shrubs. The charming little *Berberis Thunbergi* is a model of beauty and utility, owing to the brilliant autumnal tints of its foliage and abundant crops of scarlet fruit. Other good plants for special uses are Russian mulberry, Rhamnus, and *Ligustrum Ibota*.

JOSIAH HOOPES.

HEDÝCHIUM (Greek, *sweet snow;* the large white fls. are sweet scented). *Scitaminàceæ.* BUTTERFLY LILY. GINGER LILY. GARLAND FLOWER. Something like 25 tropical Asian erect, leafy, rhizomatous herbs allied to canna and ginger. Fls. in a terminal spike or thyrse; stamen 1, with a 2-loculed anther surrounding the style; staminodia sometimes present; flower-tube slender, with six divisions, one of which is enlarged and lip-like. Hedychiums are strong-growing plants, very ornamental, both in foliage and in flower. They are essentially fall bloomers, although they may be made to bloom more or less continuously under glass. After blooming, gradually dry off the rhizomes, and let them rest for a time. Pot them up in spring or early summer, and give them rich soil and plenty of water and an occasional supply of liquid manure. The rhizomes may be divided every two or three years. They need an abundance of water. In fact, the pots may be set half their depth in water, and *H. coronarium* is often immersed until only the crown is emersed. The common white-flowered species is *H. coronarium*. This requires warmhouse treatment for best results, although it often flowers well when plunged in a warm, half-shady place in the open. The species do not stand frost, but they may be left out in the South if well protected. The flowers are very fragrant; in fact, their odor may be too heavy for a small room.

A. *Fls. white.*

coronàrium, Kœnig. Three to 5 ft.: lvs. canna-like, green, pointed: fls. very large (3–4 in. across), long-tubed, pure white or the lip sometimes blotched green, the 3 outer segments narrow, the lip large and erect and more or less lobed. India. B.M. 708. L.B.C. 6:507. —Handsome and worthy. Needs warm quarters. Said to have been sold as *Myrosma cannæfolia*, but that name belongs to a wholly different plant.

AA. *Fls. yellow or red.*

flàvum, Roxbg. Fls. large, orange; corolla tube cylindrical, 2½ in. long; segments spreading, the outer ones linear, acute and an inch or so long, the lip very large and rounded, retuse; stamen not exserted. India. B.M. 3039 (and 2378 ?).

Gardneriànum, Roscoe. Tall: fls. light yellow, odd, short-stalked in the terminal spike, but the red filament long-projected beyond the segments; lip oval and short 3-toothed, the other segments narrow: fr. red and showy. India. B.M. 6913. B.R. 9:774. J.H. III. 32:239 (in fruit). G.C. III. 11:176 (plate erroneously labeled *H. coronarium*).—The best of the genus, and hardier than *H. coronarium*.

coccineum, Buch.-Ham. Fls. rather small, scarlet, the filament long-projected; lip nearly or quite entire: fl.-bracts conspicuous. India. L.B.C. 8:705.

L. H. B.

HEDÝSARUM (Greek for *sweet smell*). *Leguminòsæ.* Two or 3 North American herbs, and about 60 in the Old World. Perennial herbs or subshrubs, with odd pinnate lvs., and often showy racemes of red, purple or white, small pea-like fls.; calyx 5-cleft, the teeth nearly equal. Standard obcordate or obovate; keel nearly straight and longer than the wings; stamens 9 and 1; fr. a flattened jointed pod. Very closely allied to Desmodium, but the latter genus has 3-foliate lvs. Many of the Hedysarums are attractive border plants. They are of easiest culture in a light and open, well-drained soil. Give a sunny place. Hardy. Prop. by division and seeds. For the Sainfoin, sometimes known as *H. Onobrychis*, see *Onobrychis*.

A. *Fls. normally red (varying to white).*

coronàrium, Linn. FRENCH HONEYSUCKLE. Perennial or biennial, 2–4 ft. tall, branchy. An old garden plant with red, fragrant fls., crowded in axillary spikes or racemes: lvs. with 3–7 pairs of elliptic or roundish, somewhat pubescent lfts. Eu. Var. **álbum**, Hort., has white fls.

AA. *Fls. normally purple* (*varying to white*).

multijùgum, Maxim. Hardy perennial of angular, straggling growth, 2–5 ft. high, very showy, and worthy of general cult. Fls. violet or purplish magenta, with yellow blotches, in racemes 8–18 in. long, all summer: lvs. 4–6 in. long, containing 6–12 pairs of grayish green oval, small lfts. Mongolia. Gn. 53:1170. G.C. III. 18:8, 9.—Of recent introduction. Very fine for rockwork.

boreàle, Nutt. (*H. Americànum*, Britt.). Erect or half-decumbent herb, simply or nearly so, 1–3 ft.: lfts. 5–10 pairs, glabrous, oblong or oblanceolate: fls. violet-purple, varying to white, the calyx teeth ovate-acute and shorter than the tube. Labrador and northern N. England across the continent.

Mackénzii, Richards. Much like the last, but somewhat pubescent: fls. larger, calyx teeth awl-like and acuminate, and longer than the tube. Colo. N. and W.

L. H. B.

HEDYSCÈPE (Greek, *sweet covering*). *Palmàceæ.* UMBRELLA PALM. This includes one of the many palms known to the trade as a Kentia, and resembles that genus in habit and foliage, but is distinct in flower. In Kentia the fls. are arranged in 4 ranks, and the ovule is fastened at the bottom of the cell, while in Hedyscepe (and its cultivated allies, Kentiopsis, Veitchia, Nenga, Archontophœnix, Rhopalostylis and Dictyosperma) the fls. are spirally arranged in the branches of the spadix, and the ovule is fastened at the side. From the allies above mentioned Hedyscepe is distinguished by the following characters: staminate fls. with narrowly lanceolate sepals, 9–12 stamens, with long filaments; pistillate fls. with petals like the sepals and valvate at the apex. As a house plant, *H. Canterburyana* is dwarfer and more spreading than the two Howeas, and has a lighter shade of green.

H. Canterburyana, a very handsome palm, is the only species belonging to the genus, and, like the important Howeas (or Kentias of commercial horticulture), is only known in a wild state on Lord Howe's Island, where it is known as the "Umbrella Palm" from the recurving habit of its foliage. It grows at a greater altitude than the Howeas, not appearing below the 900-feet level, and from this it may be inferred that a slightly lower temperature is more suitable for this palm; but in a general way the same conditions as those required by the so-called Kentias will give good results with this subject, namely, a night temperature of 60° to 62° F., moderate shading throughout nearly the whole year, plenty of water, and a rich and rather heavy soil. These palms respond freely to generous treatment. As a commercial palm, *H. Canterburyana* is not very popular as yet, partly owing to the higher cost of seeds and the frequently low percentage of germination, and partly from the fact that in a young state this palm is by no means a rapid grower. In regard to hardiness of foliage, it is fully equal to the Kentias, and for gracefulness and symmetry of growth will compare favorably with any of the commercial species. In S. Calif. it is cult. outdoors.

1024. Hedyscepe Canterburyana.

Canterburyàna, H. Wendl. & Drude (*Kéntia Canterburyàna*, F. Muell.). UMBRELLA PALM. Fig. 1024. Tall. spineless palm, with a thick, stout caudex: lvs. terminal, dense, equally pinnatisect, the numerous segments linear-lanceolate, acuminate, the lower nerves recurved at the base, rather remote from the margin; rachis arched, recurving: spadix with a short peduncle, and thickened, flexuose branches; areolæ lax: fls. medium: fr. ovoid, large. R.H. 1873, p. 218. F.R. 1:85. The illustration (Fig. 1024) is adapted from Martius.

JARED G. SMITH and W. H. TAPLIN.

HEÈRIA (commemorative of Oswald Heer, Swiss botanist). *Melastomàceæ.* Includes *Heterocéntron.* According to the latest monographer (Cogniaux, DC. Monogr. Phaner. 7), the genus has 6 Mexican and Central American species. They are herbs or shrubs, erect or prostrate, with opposite membranaceous pinnately nerved (rarely 3-nerved) entire lvs., and white, rose or purple irregular fls. in panicles or rarely solitary. Not to be confounded with Centradenia, which has winged stems, unequal-sided lvs. and calyx teeth small and much shorter than the calyx tube. Stamens 8, very unequal, the 4 larger ones with long appendages or connections: ovary loculed: petals 4.—Warmhouse plants, requiring the culture of Centradenia, but grown chiefly for the fls., whereas Centradenias are grown also for foliage. **H. ròsea**, Triana (*Heterocéntron Mexicànum*, Naud., *H. ròseum*, Br. & Bouché) is the only species in general cult. A foot or more high, with 4-angled (but not winged) stem: lvs. elliptic, obtuse or acute, pinnate-nerved: fls. bright rose, in a large, terminal panicle, showy. B.M. 5166. I.H. 3:97. Var. **álba**, Hook., is a white-fld. form.

L. H. B.

HELENIÓPSIS. See *Heloniopsis.*

HELÈNIUM (possibly the author had in mind Helenus, the son of Priam, but he left no record of the application of this name). *Compósitæ.* SNEEZE WEED. About 25 species of hardy annual and perennial herbs, bearing yellow fls. from early summer to late autumn. Only the perennials are in cultivation. Stem erect, usually branching above: lvs. alternate, narrowly to broadly lanceolate, entire or toothed, glandular-dotted; petiole and stem sometimes winged: heads solitary or corymbose, yellow or brownish.

The genus closely resembles Helianthus, but differs in having elongated, often top-shaped fruits, which are never compressed and are usually silky villose; while the fruits of Helianthus are generally more or less 4-sided and are smooth. In Helenium the receptacle is naked; in Helianthus it bears paleaceous bracts, which subtend the florets.

Heleniums thrive best in a rich, moist soil, with a sunny aspect, and are propagated by seeds, cuttings or division. All the species are very easily grown, the only serious difficulty being a white aphis which sometimes attacks the roots. If plants look unhealthy they should be lifted, washed with an insecticide and reset in a new place. The commonest species in cult. is *H. autumnale*, but perhaps the most valuable species for general planting is *H. Hoopesii*, which is one of our earliest blooming composites, and is also desirable for the border or for cut-flowers. *H. Hoopesii*, *Bolanderii* and *autumnale* will give bloom in succession from May–Oct. The first two are also attractive when grown in pots, but they do not flower from seed the first year, either in pots or in the open.

A. *Stem and branches winged.*

B. *Disk yellow.*

autumnàle, Linn. (*H. grandiflòrum*, Nutt.). Fig. 1025. Stem 2–6 ft. high, roughish, leafy: lvs. mostly toothed, smooth: heads 1–1½ in. across, numerous, borne at the end of short, very leafy stalks: rays drooping, 3-cleft, lemon-yellow to rich orange; disk yellow. July–Oct.

Moist places, Can. to Fla. and west to B. C. and Ariz. B.M. 2994. Gn. 29:533; 55:1216. A.G. 12:682. G.C. III. 10:433.—Very showy. It has distinct merit for the back of borders, but is more appreciated in Europe than in America. There are several garden forms: var. **pùmilum** is 1–2 ft. high, a very free bloomer, and is largely grown for cut-flowers in some places; var. **grandiflòrum** and var. **supérbum** are unusually vigorous and large-fld.; var. **striàtum** has a maroon and gold disk, with yellow rays variously striped and splashed with rich crimson. J. H. III. 31:293. This should be distinguished from the striped forms of *H. nudiflorum*.

1025. Helenium autumnale.
Commonly known as Sneezeweed.

BB. *Disk brown or purplish.*

C. *Lvs. all entire: heads solitary or few, long-stalked.*

Bigelovii, Gray. Stem 2–3 ft. high, nearly smooth: upper lvs. narrow to oblong-lanceolate, lower spatulate: heads commonly 1½–2½ in. broad: rays ¾ in. long: flower-stalk slender. Aug. Wet ground, Calif. S.H. 1:373.

Bolánderi, Gray. Stem 1–2 ft. high, stout, somewhat pubescent: lvs. oblong to ovate-lanceolate; the lower obovate: heads commonly 3 in. wide: rays often 1 in. long: flower-stalks thick, hollow. June–Sept. Low ground, N. E. Calif. Gn. 29, p. 191. R.H. 1891, p. 377.—Sometimes grown as *H. grandiflorus*.

CC. *Lower lvs. toothed: heads numerous, corymbose, short-stalked.*

nudiflòrum, Nutt. Stem 1–3 ft. high, roughish, leafy: lower lvs. spatulate, toothed: heads 1–1½ in. across: rays wedge-shaped, drooping, yellow, brown-purple or striped with both colors. July–Oct. Moist soils, N. C. to Fla., west to Ill. and Tex.—A garden form, var. **grandicéphalum striàtum**, has fls. over 2 in. across.

AA. *Stem and branches not winged.*

Hoòpesii, Gray. Stem 1–3 ft. high, stout, slightly tomentose when young, but soon smooth, branching above into an umbel of several to many fls.: lvs. thickish, entire: heads usually borne singly on long stalks, commonly 3 in. wide: rays but slightly drooping; disk yellow. May–Sept. Rocky Mts.—A very fine border plant, and especially valuable for cut-fls.

H. Doùglasii, Hort.=Monolopia major.—*H. tenuifòlium*, Nutt. Annual. A weed in the southern Atlantic and southwestern states. Stem 8 in. to 2 ft. high, very leafy: lvs. thread-like, entire, sessile, often whorled. Va., Fla., west to Mo. and Tex.

S. W. FLETCHER.

HELIANTHÉLLA (Greek, *resembling Helianthus*). *Compósitæ.* Eleven species of hardy perennial herbs from North Amer., with showy yellow fls. borne in autumn. The species described below is advertised by a western dealer in native plants. Stem commonly unbranched: lvs. mostly scattered and sessile, linear or lanceolate, entire: heads solitary or few, with yellow rays and a yellow or brownish disk. The single species in cultivation is easily grown in a variety of soils, and is propagated by seeds or by dividing the rootstocks.

Helianthella belongs to a group of genera distinguished from Helianthus by having the fruits laterally compressed instead of thick and obtusely angled. Other cultivated genera of this group are Actinomeris, Encelia and Verbesina, which are distinguished from one another by combinations of fruit and pappus characters.

quinquenérvis, Gray. Stem 2–4 ft. high, nearly smooth: lvs. mostly opposite, 4–9 in. long: heads 3–5 in. broad, long-stalked, solitary or a few below in the axils of the lvs., with an involucre of large, leafy bracts: rays pale yellow, 1½ in. long. June–Sept. Rocky Mts.

S. W. FLETCHER.

HELIÁNTHEMUM (Greek for *sun flower*). *Cistàceæ.* ROCK ROSE. SUN ROSE. FROSTWEED. Herbs or subshrubs in temperate and warm climates of Old and New Worlds. The species are confused, and estimates of their numbers vary from 30 to more than 100. Fls. opening in the sun, mostly yellow, usually in terminal clusters; petals 5, soon falling; stamens many: ovary imperfectly 3-loculed, containing numerous seeds; style 1: stems hard and more or less woody: lvs. small, linear or oblong, entire, often grayish. Helianthemums are evergreens or nearly so, forming low mats of herbage, and bearing a profusion of fls. in hot weather. They are especially adapted for rockwork and borders. They thrive in rather poor soil. Although the following species are fairly hardy in the North, they profit by a protection of mulch. Prop. mostly by division; also by seeds and by cuttings of half-ripe wood. See *Cistus*. Sweet's "Cistineæ" (1825–1830, London) is the monumental work on these plants. See, also, Nicholson in Gn. 26, p. 420, for a running account of the garden forms.

Canadénse, Michx. FROSTWEED. Diffuse, 2 ft. or less high, caulescent: lvs. oblong, linear, or oblanceolate, nearly sessile: fls. solitary or 2 together, 1 in. across, bright yellow, the sepals hairy. In rocky and sandy soil, Me. to N. C. and Wis. G.W.F. 29.—Sold by collectors. The later axillary branches produce small apetalous fls.

Chamæcistus, Mill. Usually less than 1 ft. tall, procumbent, forming mats: lvs. linear-lanceolate or broader, numerous at the base of the plant, small, hoary beneath but green and hairy above: fls. normally yellow, in loose, more or less nodding racemes, on hairy pedicels. Eu., N. Afr., W. Asia.—This is the commonly cult. species, running into many forms. It is much less grown in this country than in Eu. It is an excellent rockwork plant. There are double-flowered forms; also forms with red and copper-colored fls. The following names occurring in trade lists are to be referred to this species-group: *angustifòlium*, *álba-plèno*, *auràntea-plèno*, *cròceum*, *cùpreum*, *grandiflòrum*, *hyssopifòlium*, *lùtea plèno*, *mutábile*, *purpùrea-plèno*, *rhodánthemum*, *rhodánthum*, *variábile*, *vulgàre*.

ocymoides, Pers. (*H. Algarvénse*, Dun. *Cistus Algarvénse*, Sims). Shrub, 2–3 ft., twiggy, nearly erect, hoary-pubescent: lvs. opposite, linear-oblong or spatulate, the tips recurved: fls. bright yellow with a purple eye, 1½ in. across, in corymbose clusters. Spain and Portugal. B.M. 5621.—Little known in this country. Hardy in England.

formòsum, Dun. (*Cistus formòsus*, Curt.). Spreading, much-branched, tomentose, but becoming nearly or quite glabrous with age: lvs. elliptic to lance-obovate, short-stalked: fls. large (2 in. across), yellow, with black eye, on slender, hairy pedicels. Portugal. B.M. 264. Gn. 26:466; 53, p. 131. G.M. 34:246.—Perhaps the most showy of the genus. Excellent for rockwork. The branches are erect, reaching 3–4 ft. Not hardy North.

umbellàtum, Mill. Diffuse, 1–2 ft. tall: lvs. small, linear or linear-lanceolate, revolute on margins, more or less viscid: fls. umbellate or whorled, white. Eu.

L. H. B.

HELIÁNTHUS (Greek, *helios*, the sun, and *anthos*, a flower). *Compósitæ*. SUNFLOWER. This genus includes the common annual Sunflower, and about 15 hardy herbaceous perennial plants, rather coarse in habit, with yellow fls., which are mostly large, numerous and borne in autumn. Altogether there are about 80 species, mostly N. American. Lvs. generally opposite below and alternate above, but this is not a constant character: heads pedunculate, solitary or corymbose, terminating the stem or branches: disk-fls. perfect, yellow, brown or purplish, with a tubular 5-limbed corolla; rays neutral, yellow. The genus is very variable, and there are also many natural hybrids; hence the species are difficult to delimit. The old notion that the flower-heads follow the sun from east to west has recently been substantiated for *H. annuus*. (See Botanical Gazette, vol. 29:197.) Garden monographs are found in Gn. 27, p. 66; 45, p. 372; 49, p. 326 and 55, p. 146.

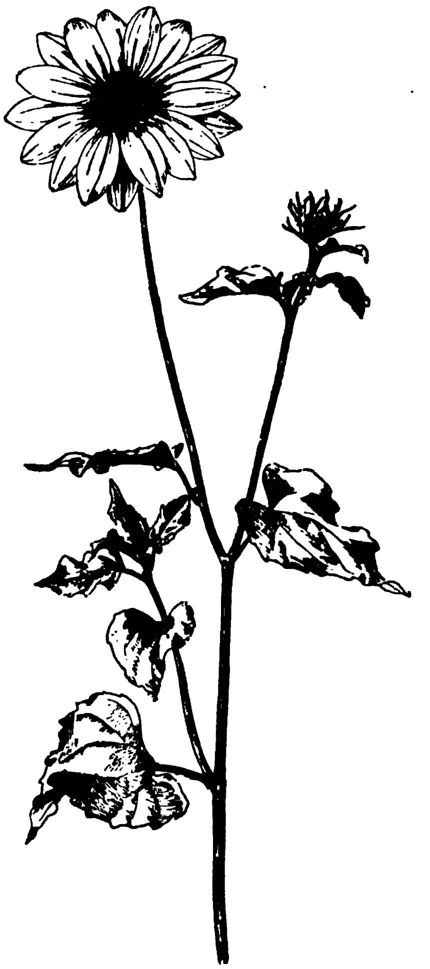
Sunflowers are of the easiest culture, and are adapted to a variety of soils. They are seen to best advantage when planted in masses, rather than as solitary specimens, and should be given plenty of room, being gross feeders.

Most Sunflowers, especially *H. annuus*, are too coarse to be harmonious near the house, but find an effective setting in the background, against the shrubbery border. A few species, however, especially *H. orgyalis* and *H. debilis*, are worth growing for their foliage alone. The annual species are prop. by seeds or cuttings; the perennial chiefly by division. All varieties of *H. multiflorus* root readily from both soft and hardwood cuttings. The double forms rarely produce fertile seeds and must be prop. by division. The seeds of annuals may be planted directly in the border, but it is best to start them indoors in March. Perennial kinds, particularly forms of *H. multiflorus*, should be taken up in late fall or early spring, every two years, and the rootstocks divided and replanted; otherwise the roots will ramble away, and the flowers will deteriorate. All thrive in a light, dry soil; but *H. annuus* and *H. giganteus* may be used to advantage for drying malarial spots. Sunflowers do not thrive in very shady places.

S. W. FLETCHER.

Sunflowers (*H. annuus*) are cultivated extensively in Russia, India and Egypt; less widely in Turkey, Germany, Italy and France. The seeds from the large-seeded variety are sold upon the streets in Russia as we do peanuts, except that they are eaten raw. The small-seeded variety is preferred for the manufacture of oil. When cold-pressed, a citron-yellow, sweet-tasting oil, considered equal to olive or almond oil for table use, is produced. The resulting oil-cake, when warm-pressed, yields a less edible fluid, which is used for lighting, and in such arts as woollen dressing, candle- and soap-making. The oils dry slowly, become turbid at ordinary temperatures and solid at 4° F. For stock and poultry feeding, and for other purposes, Sunflower oil-cake is about equal in value to that of flax- and cotton-seed. The cake is largely exported by Russia to Denmark and Sweden, and to some extent to other European markets. Sunflower stems and heads make an excellent paper, and the stems furnish a fine fiber that compares favorably with silk. They are, however, generally used for fuel, since the above industries have not been developed.

Sunflowers grow readily in many soils, but best results are obtained upon light, rich, calcareous or alluvial land, well supplied with moisture and unshaded by trees. White, clayey and poor soils are unfavorable. Preparation of the soil should be thorough; deep fall plowing followed by spring harrowing being preferred to spring preparation. The seeds are generally sown in drills running north and south, 30 in. apart, 9 in. asunder in the drill, and 1 in. deep. Sometimes they are transplanted from nursery beds when 4–6 in. tall. About a week after the plants appear they are thinned to 18 in. asunder. From 4 to 6 pounds of the seed will sow an acre. Cultivation is the same as for corn, except that when the plants reach a height of 3–4 ft., the inferior flower heads should be removed, leaving only 4 or 5 on the principal stem. In windy climates hilling is sometimes necessary to prevent blowing down.



1026. Helianthus debilis. Nearly half size.

On some farms the roots are harvested as they ripen and placed upon floors or movable pole racks to dry. Upon larger areas they are cut to the ground when most of the heads have ripened and piled, heads up, to cure. The former method insures a much higher grade of oil, and is therefore preferred. Every effort is made to prevent fermentation, either in the heads or in the pile of seeds, since this injures the quality of the oil. When thoroughly dry the heads are either placed on racks or piled, face downward, on a floor and beaten with flails. The seeds are then spread thinly, shoveled over occasionally, and allowed to become perfectly dry before being sent to the mill. The average yield is about 50 bushels to the acre. The percentage of husks ranges from 40 to 60; and the oil from 15 to 28. As a general rule, 100 bushels of seed will yield 33 bushels of kernels, 100 bushels of kernels from 280 to 320 gallons of oil of both qualities.

Russian Sunflower, a large-seeded variety, producing a single head, grows 8 ft. tall, but is less esteemed for oil production than the small-seeded varieties.

In America the Sunflower industry may be said to have hardly commenced, there being at present but two well-developed markets for the seed.
M. G. Kains.

INDEX.

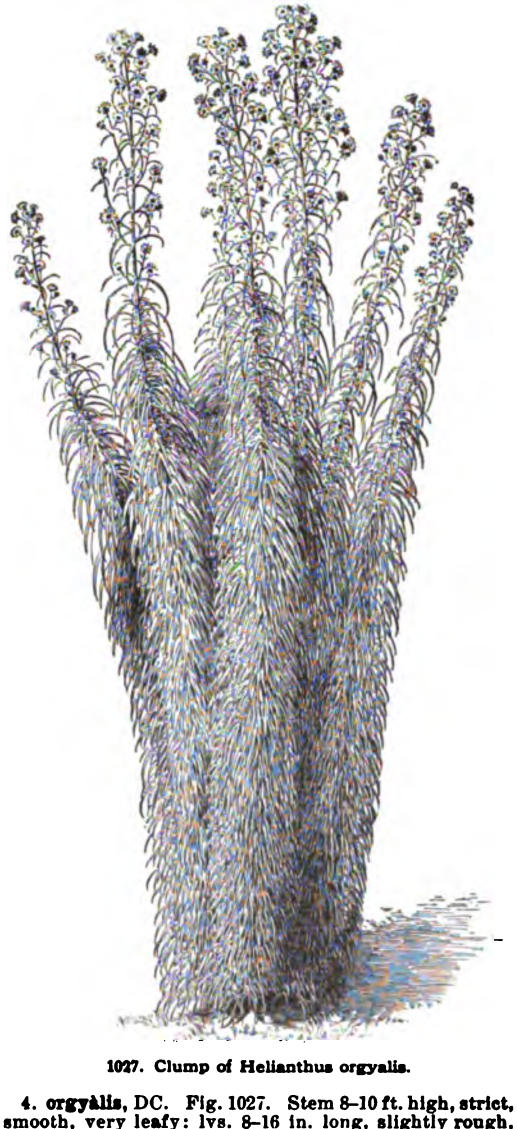
angustifolius, 5.
annuus, 1.
argophyllus, 2.
atrorubens, 7.
Californicus, 1, 20.
cucumerifolius, 3.
decapetalus, 11.
debilis, 3.
divaricatus, 12.
doronicoides, 16.
giganteus, 13.
grosse-serratus, 10.
hirsutus, 21.
lævigatus, 8.
lætiflorus, 19.
Maximiliani, 14.
Missouriensis, 6.
mollis, 17.
multiflorus, 11.
orgyalis, 4.
pumilus, 18.
rigidus, 6.
strumosus, 9.
trachelifolius, 22.
tuberosus, 15.

A. *Annuals: lvs. long-petioled: disk brown or purplish.*
  B. *Stem erect, stout, simple or branching above*........... 1. **annuus**
    2. **argophyllus**
  BB. *Stem diffuse, slender, branching freely from the base*.... 3. **debilis**
AA. *Perennials by creeping rootstocks: lvs. sessile or short-petioled.*
  B. *Disk brown or purplish.*
    C. *Lvs. linear, entire (except the lower), sessile*....... 4. **orgyalis**
      5. **angustifolius**
    CC. *Lvs. ovate to broad-lanceolate, mostly toothed, narrowed at the base into a winged petiole*........... 6. **rigidus**
      7. **atrorubens**
  BB. *Disk yellowish.*
    C. *Stem smooth below, the branches often slightly rough or pubescent.*
      D. *Lvs. pale beneath*...... 8. **lævigatus**
        9. **strumosus**
        10. **grosse-serratus**
      DD. *Lvs. green on both sides*.11. **decapetalus**
        12. **divaricatus**
    CC. *Stem rough or hairy below.*
      D. *Rootstocks thickened into one or more fleshy tubers*...............13. **giganteus**
        14. **Maximiliani**
        15. **tuberosus**
      DD. *Rootstocks all slender.*
        E. *Lower lvs. sessile or with a clasping base*..............16. **doronicoides**
          17. **mollis**
        EE. *Lower lvs. short-petioled.*
          F. *Stem 1-2 ft., not branching*.....18. **pumilus**
          FF. *Stem usually over 3 ft., branching*.19. **lætiflorus**
            20. **Californicus**
            21. **hirsutus**
            22. **trachelifolius**

1. **ánnuus**, Linn. Common Sunflower. Stem 3–12 ft., rough-hairy, often mottled: lvs. 4–12 in. long, broadly ovate, acute, the lower cordate, coarsely serrate, rough on both sides: fls. 3–6 in. wide in wild specimens, often 14 in cult. July–Sept. Minn. to Tex., west to Wash. and Cal. Gn. 27, p. 68. Gt. 43, p. 95 (as *H. lenticularis*). B. R. 15:1265 (as *H. lenticularis*).—A valuable economic and ornamental plant. The lvs. are used for fodder, the fls. yield a yellow dye, the seeds furnish an oil and are used for food. It is grown for food chiefly in Russia. *H. annuus* has long been in cult. as an ornamental, and has varied into many distinct forms. Common varieties are: Var. **Califórnicus**, very large and double; var. **citrinus**, with primrose-colored rays (Gn. 49, p. 327); var. **globòsus fistulòsus**, having enormous globular heads; var. **nànus fl. pl.** (Globe of Gold), dwarf and double, valuable for borders; **Russian Giant**, 10–12 ft. high, single, grown mostly for seed; var. **variegàtus**, with variegated lvs., but not especially attractive.

2. **argophýllus**, Torr. & Gray. Silvery-leaved Sunflower. Stem usually 4–5 ft. high, soft grey, with a dense, silky pubescence, especially the upper branches. Otherwise like *H. annuus*, into which it seems to vary under cultivation if the seedlings are not constantly selected for their silky character. Texas. The var. **Texàna**, Hort., which does not differ botanically from the type, is an attractive form of this species. R. H. 1857, p. 431. Gn. 12, p. 280; 27, p. 67; 55, p. 147.

3. **débilis**, Nutt. (*H. cucumerifòlius*, Torr. & Gray). Cucumber-leaved Sunflower. Fig. 1026. St. 1–4 ft. high, hairy throughout: branches often mottled with purple or white, each one bearing a fl.: lvs. 1–4 in. long, ovate to triangular, generally with a cordate base, thin, glossy, irregularly toothed or entire: fls. 2–3 in. wide, on slender peduncles. July–Sept. Fla. to Texas and westward. G.C. III. 17:167. Gt. 44, p. 571. B.M. 7432. Gn. 49:1064.—This is one of the best for cut-fls. It needs a sandy soil.



1027. Clump of Helianthus orgyalis.

4. **orgyàlis**, DC. Fig. 1027. Stem 8–10 ft. high, strict, smooth, very leafy: lvs. 8–16 in. long, slightly rough, drooping: fls. numerous, lemon-yellow. Sept., Oct. Dry plains, Neb. to Tex. and westward. Gn. 27, p. 67; 55, p. 147. F.R. 2:146.—This species has distinct and

attractive foliage, which is not at all coarse. A well grown plant will produce spikes of fls. nearly 4 ft. long.

5. **angustifòlius**, Linn. Swamp Sunflower. Stem 2–6 ft. high, simple or branching above, slightly rough: lvs. 2–7 in. long, somewhat tufted, drooping, with rolled edges, smooth or slightly rough: fls. 2–3 in. wide, few or solitary. Aug.–Oct. Wet land, N. Y. to Fla., west to Ky. and Tex. B.M. 2051.

6. **rigidus**, Desf. (*H. Missouriénsis*, Schwein.). St. 1–3 ft. high (rarely 5–8 ft.), strict, sparingly branched, rough or hairy: lvs. 6–12 in. long, oblong to ovate-lanceolate, firm, thick, rough-hairy, entire or slightly toothed: fls. 2½–4 in. wide, showy, long-stalked; rays numerous, about 1½ in. long; disk sometimes yellow at first, turning brown. Aug.–Oct. Mich. to Tex. and west to Col. B.R. 6:508 (as *H. atrorubens*). B.M. 2020 (as *H. diffusus*). B.M. 2668 (as *H. atrorubens*). Gn. 27, p. 68.—After *H. decapetalus* this species is one of the best perennial Sunflowers. It varies under cultivation chiefly in the direction of doubling and in lengthening the blooming period. Some of the best garden varieties are **æstivàlis, grandiflòrus, semi-plènus** and Miss Mellish.

7. **atrórubens**, Linn. Purple-disk Sunflower. St. 2–5 ft. high: lvs. usually thin, sometimes hoary beneath: fls. about 2 in. across; rays few (10 to 16), rarely over 1 in. long; disk dark red. Otherwise like *H. rigidus*, to which it is inferior. Va. to Fla., west to Ohio and La.

8. **lævigàtus**, Torr. & Gray. Stem 2–5 ft., simple or branched above: lvs. 3–6 in. long, lanceolate, smooth, entire or slightly toothed: fls. 1–1½ in. broad, few or solitary; rays 6–10, usually less than 1 in. long. Aug.–Oct. Va. to N. C.

1028. Helianthus decapetalus, var. multiflorus.
(See species No. 11.)

9. **strumòsus**, Linn. St. 3–7 ft. high, usually branching, often glaucous: lvs. 3–8 in. long, ovate-lanceolate, rough above, entire or toothed: fls. 2½–4 in. across; rays 8–15, 1–1½ in. long. July–Sept. Open woods, Can. to Ga. and west to Wis. and Ark. Var. **móllis**, Torr. & Gray. Lvs. downy beneath. B.M. 3689 (as *H. mollis*, Lam.).

10. **gròsse-serràtus**, Martens. St. 6–10 ft. high, very smooth, glaucous: lvs. long-lanceolate, slender-petioled, rough above: fls. many, cymose, 1–3 in. broad. Aug.–Oct. Pa. to Mo., south to Tex.—Passes into *H. giganteus*.

11. **decapétalus**, Linn. Stem 2–5 ft. high, branched above: lvs. 3–8 in. long, ovate-lanceolate, sharply serrate, thin, rough above, finely pubescent beneath: fls. 2–3 in. across, numerous; rays generally more than 10, in spite of the specific name. July–Sept. Moist soils, Quebec to Ga., west to Mich. and Ky. G.C. II. 16:601.—Under cult. it has given rise to the horticultural var. **multiflòrus** (*H. multiflòrus*, Hort.). Fig. 1028. B.M. 227. G.C. III. 10:421. Gn. 27:476, pp. 71, 74; 45, p. 373. Gt. 43, p. 554. Gng. 3:83. F.R. 2:413. The many garden forms of var. *multiflorus* differ mainly in the extent of doubling, season of blooming, habit of plant and size of fl. Among the best are: Var. **flòre plèno** and var. **grandiflòrus**, almost completely double; var. **màjor**, fls. larger than common; var. **máximus**, very large, single fls. with pointed rays; **Soliel d'Or**, with quilled florets, like a Cactus Dahlia. Multiflorus varieties are the most popular of perennial Sunflowers, and deservedly so. If the double forms are grown on poor soil, or are allowed to remain for several years without being divided, they become single.

1029. Helianthus divaricatus.

12. **divaricàtus**, Linn. Fig. 1029. Stem 1–6 ft. high: lvs. sessile, rough above, pubescent beneath, standing out nearly at right angles to the stem: fls. few or solitary, 2 in. across. July–Sept. Dry woodlands, Can. to Fla., west to Neb. and La.

13. **gigantèus**, Linn. Indian Potato. Stem 3–12 ft. high, stout: lvs. 3–7 in. long, lanceolate, very rough, serrate or nearly entire: fls. usually several, 1½–3 in. broad, mostly long-stalked; rays 10–20, barely 1 in. long, cupped, pale yellow: seeds smooth. Aug.–Oct. Wet ground, Can. to Fla., west to Neb. B.M. 7555. D. 165.—Var. **subtuberòsus**, Bourgeau. A northern form with unusually fleshy roots, which were formerly collected by Indians for food. Hence "Indian Potato."

14. **Maximiliani**, Schrad. Stem generally 2–4 ft. high, sometimes 8–10: lvs. inclined to be trough-shaped: fls. on short, densely pubescent peduncles; rays 15–30, generally 1½ in. long, deep yellow. Otherwise like *H. giganteus*, of which it is probably the western form. Aug.–Oct. Dry plains, west of Mississippi river.

15. **tuberòsus**, Linn. Jerusalem Artichoke. Stem 5–12 ft., branched above. lvs. 4–8 in., usually ovate, acuminate, serrate, rough above, finely pubescent beneath: fls. several or numerous, 2–3 in. across; rays 12–20: seeds pubescent. Gn. 27:68. B.M. 7545.—Frequently cultivated for its edible tubers. See *Artichoke, Jerusalem*.

16. **doronicoides**, Lam. Stem 3–7 ft. high: lvs. 4–8 in. long, ovate oblong, narrowed towards both ends, rough on both sides: fls. numerous, in loose panicles; rays 12–20, broad. Otherwise as *H. lætifolius*. Aug., Sept. Dry soils, Ohio to Mo. B.M. 2778 (as *H. pubescens*).

17. **móllis**, Lam. Stem 2–5 ft. high, stout, very leafy, hoary villose, at least when young: lvs. 3–5 in. long, ovate-lanceolate, white-pubescent or rough on upper side: fls. solitary or few, 2–3 in. broad; rays 15–25 July–Sept. Barren soils, Ohio to Ga., west to Ia. and Tex. Gn. 55:1212.

18. **pùmilus**, Nutt. Stem rough and hairy throughout: lvs. only 5–7 pairs, 1–4 in. long, ovate-lanceolate: fls. few, short-peduncled. Eastern Rocky Mts. and adjacent plains.

19. **lætiflòrus**, Pers. Showy Sunpower. Stem 4–8 ft. high, leafy: lvs. 4–10 in. long, ovate-lanceolate, more or less serrate, rough on both sides: fls. several, 2–4 in.

broad, short-peduncled; rays 15–25, about 1½ in. long, showy. Prairies, Ind., Ill., Wis. Gn. 45:960. G.M. 31:204.—A desirable Helianthus. The garden form *H. semiplenus* is better than the type. Resembles tall-growing forms of *H. rigidus*, but disk yellow.

20. **Califórnicus**, DC. Stem 3–8 ft. high. lvs. lanceolate, rough on both sides: fls. loosely paniculate. Calif. —Most of the plants grown under this name are a garden form of *H. annuus*.

21. **hirsùtus**, Raf. Stem 2–4 ft. high, densely hairy: lvs. ovate-lanceolate, thick, very rough. pubescent and pale beneath: fls. several, 2–3 in. across. July–Oct. Dry soils, Pa. to Ga., west to Wis. and Texas.

22. **trachelifòlius**, Mill. Resembles strumosus, but stem and fl.-stalks usually rough-hairy and lvs. thinner, green on both sides. Aug., Sept. Dry soil, Pa. to Wis.

S. W. Fletcher.

HELICHRŶSUM (Greek for *sun* and *gold:* referring to the flower heads). *Compósitæ.* Syn., *Elichrŷsum.* Nearly 300 Old World herbs or shrubs, mostly African and Australian. Some of them are grown for everlastings, being, with Helipterum, amongst the most important plants for that purpose. Easily grown as hardy annuals in any garden soil. Fls. of two kinds, the outermost ones with pistils only: involucre dry and chaff-like, the stiff overlapping scales glabrous, often colored: heads large, terminating the branches, normally yellow, but now varying into many colors in long-cultivated forms.

A. *Lvs. oblong or narrow; grown for everlastings.*

B. *Heads large, solitary.*

bracteàtum, Andr. Fig. 1030. Stout annual, 1½–3 ft. tall, somewhat branched, the terete stems nearly or quite glabrous: lvs. many and rather large, oblong-lanceolate, narrowed to a short petiole, entire, green: heads terminating the branches, 1–2½ in. across, yellow or orange, the short and obtuse involucre-scales imbricated. Australia.—Perhaps the most important single everlasting fl. grown in this country, particularly for bold or heavy design work. It is very variable, particularly in color. The heads are pure white in var. **álbum**, Hort. (*H. álbum*, Hort. *H. níveum*, Grah. B.M. 3857); scales tipped with red in var. **bicolor**, Hort. (*Elichrŷsum bicolor*, Lindl. B.R. 21:1814); dark scarlet in var. **atrococcíneum**, Hort. (*H. atrococcineum*, Hort.); dark blood-red in var. **atrosanguíneum**, Hort. (*H. atrosanguineum*, Hort.). The forms with very large heads are often known as *H. macránthum*, Hort. The double forms are often known as *H. monstròsum*, Hort. Other portraits of this species will be found in B.R. 24:58. R.H. 1851:101.

BB. *Heads medium to small, in clusters.*

C. *Color yellow or orange.*

arenàrium, DC. A foot or less high, herbaceous: lvs. plane, white-woolly, the lower ones oblong-obovate and long-attenuated into a petiole, the upper ones linear-lanceolate and acute: heads globular, in compact little corymbs, bright yellow. Perennial, in sand, France.—Apparently not cult. in this country. See *Everlasting.*

orientàle, Gærtn. (*Gnaphàlium orientàle*, Linn.). Stem simple, 1½ ft. or less tall: lvs. oval-oblong to lanceolate, obtuse, sessile, rather small: heads bright yellow, small, globular, in corymbs. S. Eu. to Asia Minor.—Much cult. in Mediterranean regions, but little known in this country.

apiculàtum, D. Don. Perennial, 1–2 ft., tomentose, leafy below: lvs. lance-spatulate, the base more or less spatulate: heads ⅓ in. across, in small heads or clusters. orange-yellow, the scales sharp-pointed. Australia. —Little known in this country.

CC. *Color white or nearly so.*

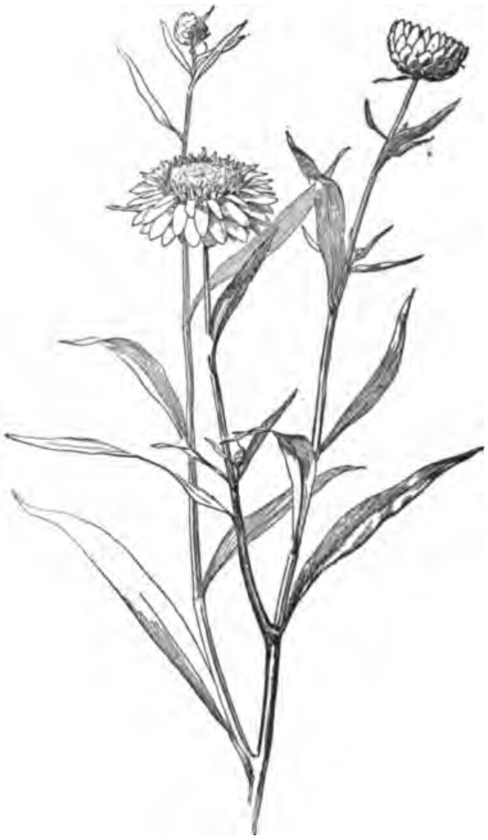
grandiflòrum, Less. Perennial, somewhat woody, decumbent at the base: lvs. crowded near the base, sessile, obovate to oval or oblong, obtuse, woolly on both sides: heads hemispherical, in corymbose clusters, glossy, cream-color, ¾in. across. S. Afr.

diosmæfòlium, Sweet. Tall, upright: lvs. very small, narrow-linear (¼in. or less long), the margins revolute: heads small and numerous, white.—Cult. in S. Calif. by Franceschi. Australia; sometimes grows 20 ft. high.

AA. *Lvs. ovate or broader: border and vase plant.*

petiolàtum, DC. (*Gnaphàlium lanàtum*, Hort.). Tender perennial, cult. for its long, woolly stems and woolly lvs., either as an edging in ribbon borders or as an ornament in lawn vases: lvs. petiolate, ovate and broad at the base, obtuse: heads (not often seen in cult.) in branched cymes, the involucre scales obtuse, cream-white. S. Afr.—An old garden plant. Prop. by cuttings from stock plants carried over winter.

L. H. B.

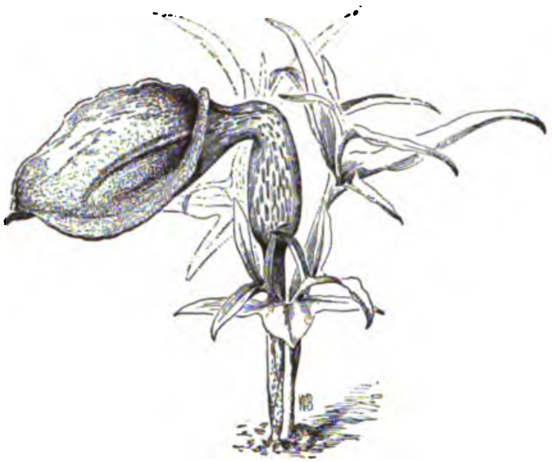


1030. Helichrysum bracteatum (× ⅓).
One of the choicest everlastings.

HELICÒDEA. See *Billbergia.*

HELICODÍCEROS (Greek, *spirally 2-horned*). *Aràceæ.* The extraordinary plant shown in Fig. 1031 is known as the "Hairy Arum" and sold by the bulb dealers as *Arum crinitum.* When in flower it has a disgusting odor, which attracts carrion flies and bright green insects, as uncanny as the plant itself. The plant is the only species in its genus, the hairiness of the spadix being a very distinct character. Helicodiceros and Dracunculus are alike in having few ovules, which are fastened at the top and bottom of the cell, but in the latter the staminate and pistillate fls. are close together, while in the former they are separated by a sterile portion. Arum differs from both genera in having the ovules fastened in 2 series at the side of the cell. The lvs. of Arum are spear- or arrow-shaped, while in the other two they are pedately cut. Latest monograph in Latin by Engler in D.C. Mon. Phan. 2:604 (1879).

This plant is worth growing once, since it is one of the great curiosities of horticulture. It may be secured from bulb dealers in the fall and flowered under glass in the spring. It is a most vile-smelling plant when in full flower. The plucky artist who drew the accompanying picture of this arum wrote at the bottom of his drawing, "Air 'em."



1031. Helicodiceros muscivorus (× ⅛).

muscivorus, Eng. (*H. crinitus*, Schott. *Àrum crinitum*, Ait. *Dracúnculus crinitus*, Schott). Fig. 1031. Height 1½ ft.: spathe-limb purple, covered with purple hairs. Corsica. B.R. 10:831. F.S. 5:445. W. M.

HELICÒNIA (Mt. Helicon, in Greece, seat of the Muses). *Scitaminàceæ.* Foliage plants allied to Musa. Perhaps 25 to 30 species in tropical America. The plants are grown in a warmhouse along with Alocasias, Anthuriums and Calatheas: the directions given for the cultivation of Calathea apply very well to Heliconia. Under the name of Wild Plantain or Balisier, *H. Bihai* is cult. outdoors in S. Fla. and along the Gulf of Mex. It is an evergreen shrub rivaling the bananas in foliage and scarlet and black flower-sheaths. E. N. Reasoner classes it among plants that sprout up readily in the extreme South if killed by frost, and recommends it as a house plant for the South.

From Musa, Heliconia differs chiefly in having a dry, often dehiscing, 3-loculed, 3-seeded fruit. Fls. in clusters below the lvs., subtended by bracts after the way of Musa; sepals 3, linear, free or somewhat joined to the corolla; corolla short-tubed; stamens 5; staminodium 1: lvs. large and striking, often beautifully marked; stems arising from a strong rootstock. Various species have been introduced into cult., but the following are the only ones appearing in the Amer. trade.

Bihái, Linn. BALISIER. WILD PLANTAIN. Becoming 10–15 ft. tall, banana-like: lvs. oval or oblong-oval, long-petioled, transversely ribbed, the blades 3–5 ft. long: blossom sheaths very large, scarlet and black, the fls. red or orange. W. Indies and S.—A most striking plant, but rarely seen in glasshouse collections. It is naturalized in the Old World tropics.

aùreo-striàta, Hort. Perhaps a form of the preceding: lvs. beautifully striped along both midrib and transverse veins with golden yellow: stems striped with yellow and green: leaf-limb oval-acuminate. I.H. 29:464; 42, p. 289 (where a list of the best kinds will be found). S.H. 2, p. 133. F.R. 3:493.—Very handsome. The best known kind.

illùstris, Hort., is of the general style of the last, but the rib and veins are marked with pink. Var. **rubricaùlis**, Hort., has more red, the petiole being bright vermilion. R.H. 1896:36 (where a review is made of the species). R.B. 21, p. 69. Gn. 52, p. 359.

angustifòlia, Hook. Dwarfer: lvs. long and narrow, 1½–2½ ft. long, 3–6 in. wide, green: fls. yellowish green, 6–10 in each red bract. S. Amer. B.M. 4475. L. H. B.

HELIÓPHILA (Greek, *sun-loving*). *Cruciferæ.* This genus includes a blue-flowered half-hardy annual, that grows about 3 in. high and is advertised at present only in the very largest catalogues of flower seeds. The genus contains about 61 species of annual and sub-shrubby perennials, natives exclusively of S. Africa. There are no near allies of garden value. The dehiscent pod is an important character of the genus. Other important generic characters are pods sessile or pedicelled, 2-celled, 2-valved: seeds in a single row, often winged. The racemes are long and leafless, and the fls. yellow, white, rosy or sky-blue. Latest monograph in English by Sonder in Flora Capensis 1:35–54 (1859–60). For general culture, see *Annuals.*

The plant in the trade is known as *H. arabioides*, Sims, which Sonder refers to **H. pilòsa**, Lam., var. **incisa**, Sonder. *H. pilosa* is a very variable species, with stem 6–24 in. high, erect or diffuse, simple or unbranched from the base: lower lvs. often opposite, the rest alternate: fls. normally sky-blue, with a yellow center, but the natural varieties include lilac and yellow. The typical *H. pilosa* has a stem that is rough with spreading hairs: lvs. hairy, either oblong or linear, entire or sometimes lobed near apex, cuneate at base: pods linear, erect or spreading. Var. **incisa**, Sonders, has lvs. linear-cuneate, 3-cut at the apex, rarely 5-cut, the lobes linear or acuminate. B.M. 496. W. M.

HELIÓPSIS (Greek, *like the sun*). *Compósitæ.* About 10 species of hardy herbaceous plants, bearing numerous yellow fls. in autumn, and all native to N. America. They are all perennials except one, and that is not cultivated. They are not common in gardens because of the more attractive forms in Helianthus. *H. lævis*, var. *Pitcheriana*, however, deserves wider popularity. Heliopsis has no pappus, while in Helianthus the pappus has 2 awns. In Heliopsis the rays have pistils, but may be fertile or sterile. In Helianthus the rays have no pistils at all. Stem erect, loosely branching: heads yellow, long-stalked, borne in loose terminal or axillary panicles: lvs. opposite, petioled, 3-ribbed, oblong-ovate to ovate-lanceolate, coarsely toothed. For culture, see *Helianthus.*

lævis, Pers. Stem 3–5 ft. high: lvs. 3–5 in. long, thinnish, smooth on both sides or roughish above: fls. numerous, 1½–2½ in. broad, long-stemmed. July–Oct. Open places, Can. to Fla., west to Ill. and Ky. B.M. 3372. Var. **Pitcheriàna** (*H. Pitcheriàna*, Hort.). A dwarf, more branching and bushy form, 2–3 ft. high, with a spread of 3–4 ft.: fls. produced much more freely than in the preceding and a deeper yellow. One of the best hardy plants for the perennial border, being especially valuable for cutting and for planting in dry places. Int. 1895 by Pitcher & Manda. A.G. 16:323. F.R. 2:259.

scàbra, Dunal. Differs from *H. lævis* chiefly in being rough throughout: upper lvs. sometimes entire: heads few, often solitary. Dry soils, Me. to N. J. and west to Mo. J.H. 33:359. B.R. 7:592 (as *H. canescens*).—Passes into lævis. S. W. FLETCHER.

HELIOTROPE. See *Heliotropium.*

HELIOTRÒPIUM (heliotropic; *turning to the sun*). *Boraginàceæ.* A widely spread genus in warm regions, of more than 100 species. Herbs or rarely shrubs, with small flowers in terminal, forking clusters and alternate simple leaves: corolla short funnel-form or salver-shape, the throat mostly open (sometimes constricted); stamens 5, attached to the tube, not exserted, the filaments very short: ovary 4-loculed and splitting into 4 nutlets (or two 2-loculed nutlets) when ripe, surmounted by a simple style. There is a Heliotrope (*H. Curassávicum*, Linn.) native to the S. Atlantic states, with white fls. and oblong or linear lvs.; also a naturalized species (*H. Indicum*, Linn.) with bluish scented fls. and lance-ovate rugose lvs. The florists' Heliotropes seem to be derived from 2 species. **H. Peruviànum**, Linn., is perhaps the leading species. Fig. 1032. Lvs. oval or oblong-lanceolate, very veiny, not conspicuously narrowed at the base: fls. small, in a close cyme, the corolla tube little longer than the calyx. Peru. B.M. 141.—Vanilla-scented. **H. corymbòsum**, Ruiz & Pav.

(*H. grandiflòrum*, Don), has longer and relatively narrower lvs., which are distinctly narrowed to the base, flower-clusters larger and more open, fls. nearly twice larger and the corolla tube nearly twice longer than the calyx; calyx teeth longer and narrower. Peru. B.M. 1609. Narcissus-scented. Many of the large-trussed and large-flowered garden varieties are apparently of this species rather than of the former; or possibly the two are hybridized. Originally both species were violet-flowered, but the colors are now in various shades of purple, and there are white-flowered forms. **H. Voltaireànum**, Hort., occurs in our trade-lists. It is a compact garden form, said to be a hybrid. P.M. 16, p. 100. Another species, **H. Europæum**, Linn., is rarely seen in old collections, particularly South, and it is sparingly naturalized. It is a hoary-downy herb 6–18 in. high, with long-petioled oval lvs., and white fls. in scirpioid racemes. L. H. B.

1032. Heliotropium Peruvianum. (×⅓.)

The Heliotrope is a warmth- and sun-loving plant, preferring a rich, light soil, good drainage and plenty of water. It needs to be kept growing, and suffers more than many other plants from becoming dry. It wilts easily, and should never be allowed to lack for moisture in soil and air. Quickly becoming pot-bound, it requires frequent shifting.

The Heliotrope strikes readily from terminal cuttings of the tender shoots in about eight or ten days. Florists root the cuttings in pure sand. Cuttings should have a temperature at night of about 50°, with 5°–10° of bottom heat. They should be kept from flagging by careful watering and shading as needed. When the cuttings have formed roots about half an inch long, they should be transplanted to small pots or shallow boxes of light soil, placed where they will have a night temperature of about 60°, sheltered from currents of air, watered and shaded as needed until established.

The Heliotrope may also be grown readily from seed. These should be sown in shallow flats in light soil, in a temperature of about 65°, covered lightly and kept nicely moist. When well up they may be treated as cuttings.

For forcing, the Heliotrope should have a good exposure to the sun, a temperature of about 60° at night, rich soil, good drainage and careful watering. The plant is preferably grown in benches in 6 inches of soil. A plant easily covers an 18-inch square.

In the open ground plants should have a sunny situation and moist soil. Here it covers a space 2¼ ft. square, and attains a height of 2–3 ft. They should not be set out till danger of spring frosts is past.

The plant is comparatively free from diseases and insect pests. Cuttings and seedlings are sometimes destroyed by the damping-off fungi, and under conditions of neglect, plants sometimes become infested with mealy-bugs, aphides, or the red-spider. Sometimes plants are ruined by a disease known among florists as the "black rust," an ailment similar to or identical with that affecting the Verbena. It usually appears on plants in an enfeebled condition, resulting from being pot-bound, from sour soil or over-potting, followed by too low temperature, as well as from other causes. Badly diseased plants should be destroyed. Others are sometimes benefited by syringings and waterings with fresh and tolerably strong tobacco tea, in place of the usual waterings. Repotting and occasional applications of weak manure water, with a higher temperature, will also be found helpful. ERNEST WALKER.

Apart from its use as a border plant and for bedding, being a universal favorite, it usually forms part of the stock in trade of florists who do a local business, ranking next to the Geranium as a pot-plant for spring trade. For cut-flowers in winter it is equally popular, but its lasting qualities when cut are uncertain. Successful growers assert that for best results, strong stems and good keeping qualities, it should be grown in a moderately cool, airy house. Some of the best the writer has seen were grown in a house suited to violets and mignonette, in which the temperature seldom rose to 50° F. at night.

Stout, soft cuttings make the best plants, and root easily in a temperature of 60° F. From the time they are inserted, sufficient water must be given to prevent wilting. A propagating bed is not required. Ordinary flats will do—the medium half-leaf soil and sand. They must be well shaded for a week or so. They are very liable to the cutting bench fungus, and should be potted or boxed off as soon as rooted, which should be in ten or twelve days. Any light soil will do, and it need not be rich for the first shift.

For winter flowers, cuttings may be taken in July and treated as above. Some of the plants among the spring batch with straight stems may be grown along for standards by taking out the side shoots until 2 ft. high. These make handsome drooping specimens. By pruning about midsummer they may be kept in good condition for years. Stock intended for spring cuttings is better grown continuously in pots, as the plants lift badly in the autumn.

The plants do not lift well. The writer prefers to grow a few left-over bedding plants for stock. Cuttings struck in June or July and grown continuously indoors make the best plants for winter flowers. Tall young plants may be grown into standards by taking out the side shoots until they reach 2 or 3 feet in height, and then letting them branch out. Shifted along, they make large specimens in 12-inch pots, and may be kept in good condition for years by judicious pruning, top-dressing and the use of manure water.

Heliotrope is extensively used as a bedding plant, is a favorite in window-gardens, and is much grown by florists for cut-flowers. The ease with which it may be grown either in pots or the garden, the color and fragrance of its dainty flowers, and the continuity of bloom, have all contributed to make it a general favorite.

There have been numerous garden varieties and a number of hybrids — white and the different tints of blue predominating. Floral catalogues rarely mention, however, more than 6–8 varieties. Madame de Blonay has for years been a favorite white, while Queen of Violets is perhaps the finest of the blues. Chieftain is a lighter tint. Albert Delaux is a variety with golden variegated foliage, but variegated Heliotropes are undesirable. Among seedlings double forms occasionally appear. They have no special merit, and are seldom perpetuated.

T. D. HATFIELD.

1033. Helipterum Manglesii (×⅓). Generally known as Rhodanthe.

HELÍPTERUM (Greek for *sun* and *wing;* said to refer to the light-plumed pappus). *Compósitæ.* Including *Acroclínium* and *Rhodánthe.* About 50 species in Australia and S. Africa, of which a few are cult. as everlastings or immortelles (see *Everlastings*). The cult.

kinds are annual herbs (or grown as such), of easiest cultivation in any garden soil. Fls. mostly perfect, with 5-toothed open corollas: akenes woolly, bearing a pappus of many plumose bristles: involucre glabrous, obovate or top-shaped, silvery or rose-colored: plants mostly glabrous. This and Helichrysum are amongst the most important of everlasting flowers.

A. *Heads large, many-flowered.*

B. *Lvs. broad.*

Mánglesii, Muell. (*Rhodánthe Mánglesii,* Lindl. *Roccárdia Mánglesii,* Voss). Fig. 1033. Neat glaucous annual, 12–18 in. tall, with very slender, long pedicels, bearing pretty nodding heads: lvs. thin, oval or elliptic, clasping: involucre silvery-chaffy, the ray florets originally clear, handsome pink, but now varying to white (*R. álba,* Hort.), and to dark red (*R. atrosanguínea,* Drumm.). Var. **maculàtum** (*R. maculàta,* Drumm. *Roccárdia Mánglesii,* var. *maculàta,* Voss), is usually larger, with shorter lvs. and involucre flecked with red: rays pink or white. Austral. B.R. 20:1703.—A charming plant, and one of the few everlastings which retains much of its grace and beauty after being dried. There are double-fld. forms, i. e., those with all or nearly all the florets ligulate. Excellent also for pot culture. Seeds of the mixed vars. are sometimes sold under the name *Rhodanthe varius.*

BB. *Lvs. linear.*

ròseum, Benth. (*Acroclínium ròseum,* Hook. *Roccárdia ròsea,* Voss). Fig. 1034. Annual, 1–2 ft. high, glabrous, with many strict simple branches from the crown, each stem terminated by one large head: lvs. numerous, alternate, small and linear: rays many, pointed, bright pink (or varying to white in *H. álbum,* Hort.). Austral. B.M. 4801.—A very serviceable and handsome plant.

1034. Helipterum roseum (× ½).

1035. Helipterum Humboldtianum (× ½).

AA. *Heads small, clustered.*

Humboldtiànum, DC. (*H. Sánfordii,* Hook. *Roccárdia Humboldtiàna,* Voss). Fig. 1035. Annual (or cult. as such), erect or with a decumbent base, the stems somewhat branching: lvs. (and stems) white-tomentose, linear or lance-linear, pointed, alternate: heads small, oblong, yellow, in a dense corymbose truss. Australia. B.M. 5350.

corymbiflòrum, Schlecht. (*Roccárdia corymbiflòra,* Voss). Annual, lower than the last, more branchy: lvs. broader: heads 2–3 times larger, top-shaped, in small corymbs, the prominent rays white. Australia.

L. H. B.

HELLEBORE. See *Helleborus.*

HELLÉBORUS (ancient name of *H. orientalis,* meaning unknown). *Ranunculàceæ.* Hardy herbaceous perennials, about 8 species, natives of Europe and western Asia. Erect, with large palmately divided lvs., the basal long-petioled, the upper sessile and sometimes reduced to bracts: fls. large, white, greenish, red, purple, or yellowish; sepals 5, broad, petal-like, mainly persistent; petals small, tubular, furnished with claws; stamens many; carpels 3–10, sessile, forming leathery, many-seeded capsules, dehiscent at the apex.

All the kinds will thrive in ordinary garden soil, but for the best results use a soil of rich loam and coarse sand, with a top-dressing of rotten manure. A moist, well-drained, partially shaded situation is preferable. The species may be planted in shrubbery borders, and in rockeries, or if wanted for cut-flowers they should be planted in beds. An important point is not to disturb the plants when once established, as they are very sensitive to frequent changes of location. All the species bloom before spring arrives; a few mild days in December or January will bring out the buds of *H. niger* varieties, and the others are not far behind. They are easily forced under glass. Strong plants should be taken up into large pots and gradually inured to a warm temperature. Blossoms may thus be brought forth at any time desired in winter. Prop. best by division in fall or spring; but if seeds mature they will germinate well if planted immediately in pans or in rich, open ground. Seedlings should bear flowers the third season. Monographs by J. G. Baker in G.C. II. 7:432 (1877 and by Thos. Moore in G.C. II. 11:431 (1879).

A. *Lvs. dying annually, thin.*

viridis, Linn. Stem scapose: rootstock creeping: 1 basal leaf 8–12 in. broad, on petiole 6–10 in. long; segments 7–11, oblong, acute, sharply serrate: fl.-stem hardly exceeding the basal leaf, bearing 3–6 fls. and large, leaf-like bracts: fls. large, yellowish green; sepals broadly oblong, obtuse, spreading: capsules about 4, as long as the sepals, transversely ribbed; style erect. Eu. Nat. in eastern states. G.C. II. 25:553.—Not so much used as the other species here given.

Var. **purpuráscens,** Waldst. & Kit. Differs chiefly in the central leaf-segments being deeply palmately cleft, and the fls. much tinged with purple, especially on the outside. Hungary. B.M. 3170.

AA. *Lvs. evergreen, coriaceous.*

B. *Flower-stem never more than once forked: fls. 1 or 2.*

niger, Linn. CHRISTMAS ROSE. Fig. 1036. Stemless: rootstock short, black: only 1 leaf somewhat irregularly divided into lobes, toothed on the outer half: petiole 5–7 inches long: flower-stem simple or once branched: fls. very large; sepals white, or flushed with purple: capsules 6–8. Rocky places, Eu. B.M. 8. Gn. 55, p. 13.

Var. **angustifòlius,** Hort. (var. *minor,* Hort.). Plant and leaf similar, but fls. small. Very pretty. G.C. II. 21:85, and III. 21:19.

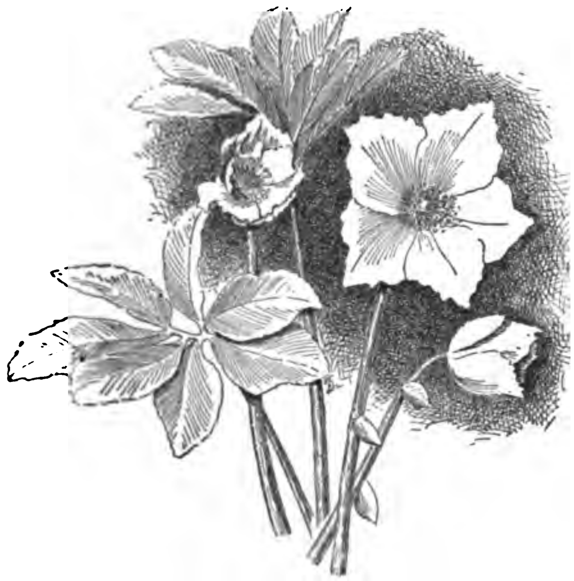
Var. **altifòlius,** Hayne (var. *màjor,* Hort. Var. *máximus,* Hort.). Petiole reaching 1 ft. in length: fls. the largest in the genus, 3–5 in. across, and often several on same stem. Gn. 14:142; 48:1021. G.C. II. 20:693. A.G. 11:63.

BB. *Flower-stem forked 2 or 3 times: fls. several or many.*

orientàlis, Lam. Stemless; short creeping rootstock: 1 radical leaf, 7–9-lobed; segments 6 in. long, 1½–2 in. broad, acute, serrate in the outer half, pubescent, with strongly raised veins beneath; petiole 1 ft. long: flower-stem over 1 ft. high, forked above, 2–6-fld., large, leaf-like bracts; sepals roundish, imbricated, white, purple beneath and purple edges, spreading: capsules oblong, shorter than the sepals, transversely ribbed: style erect or incurved. Asia Minor. Gn. 47, p. 136.—There are numerous varieties of this beautiful species.

c. *Purple-fld. varieties.*

Var. **Cólchicus**, Regel. Stem purple-spotted, quite glaucous: 1 leaf to each flower-stem: fls. 3–6 on a stem, deep bright purple, both inside and out. Asia Minor. B.M. 4581 (as *H. atrorubens*). Gt. 1860:293. Var. **Colchicus-punctàtus**, T. Moore. Fls. deeper plum-purple, more glaucous, exquisitely mottled inside with innumerable dark dots. Gn. 16:189, f. 8.—One of the handsomest of all the Hellebores.



1036. Christmas Rose. Helleborus Niger (× ⅓).

Var. **Abchásicus**, A. Braun. Much like var. **Colchicus**, but differing in having 2 or more lvs. to a flower-stem. Caucasus region. Gt. 1866:496 (as *H. Caucasicus*, var. *Abchasicus*, Regel).

Var. **atrórubens**, Waldst. & Kit. Only 1 leaf on a flower-stem, glabrous, thinner in texture than in the rest of the orientalis group: segments narrow: fls. 2–4 on a stem; sepals dark purple outside, greenish purple within. Hungary. R.H. 1865:231.—A connecting link between the viridis and orientalis groups.

Var. **rùbro-purpùreus**, Hort. (*H. atropurpùrea*, Hort.). A seedling of var. *atrorubens*, with bold foliage and purple flower-stems: fls. spreading, deep purple. Characters well fixed and very handsome. Gn. 16:189, f. 1. R.H. 1884:564.

Purple-fld. hybrids of the varieties of *H. orientalis* are found in the trade under the following names: Var. *elegans;* var. *iridescens; F. C. Heinemann*, fls. very large, imbricated, deep purple and mottled; *Frau Irene Heinemann*, fls. rose-purple outside, greenish white, with dark lines and dots inside; *Gretchen Heinemann*, red-fld., strong grower; *Hofgarten-Inspector Hartwig*, fls. rose-purple without and greenish within; *Apotheker Bogren*, rose-purple, very large.

cc. *White-fld. varieties.*

Var. **Olýmpicus**, Lindl. Glabrous: fls. small, but spreading, very numerous; sepals green on outer surface, white within. Bithynia. B.R. 28:58.—Hybrids closely allied to this have been given the trade names: *Willy Schmidt* and *Prof. Dr. Schleicher*.

Var. **guttàtus**, A. Braun. Glabrous, green stem: sepals green outside, white within and elegantly spotted with purple crimson dots. Caucasus region.—Two allied hybrid forms are named: Commers Benary and Albin Otto. Gn. 16:189, f. 4.

Var. **antiquòrum**, A. Braun. Glabrous, green mottled stem: fls. as in var. *Olympicus*, but more imbricated, maintaining the bell-shaped form. B.R. 28:34 (as *H. orientalis*, Lindl.). Gn. 16:189, f. 3.

ccc. *Green-fld. variety.*

Var. **Caucásicus**, A. Braun. Lvs. very glossy; segments more oblong than in the type, often 3 or 4 in. broad: sepals round, pale green, much imbricated. Caucasus region.

K. C. Davis.

HELMET FLOWER. *Aconitum, Coryanthes* and *Scutellaria*.

HELÒNIAS (Greek, *swamp-loving*). *Liliàceæ*. Swamp Pink. This genus includes a rare hardy perennial bulbous plant which grows in bogs from northern N. J. to N. C., and is sold by dealers in native plants. In very early spring it bears a hollow scape 1–2 ft. high, crowned by a raceme 1–3 in. long, composed of perhaps 30 pink or purplish fls., each ½ in. across, 6-lobed, and with 6 blue anthers. The genus has probably only one species, the other plants called Helonias being largely referred to other genera, which are distinguished in Britton and Brown's Illustrated Flora 1:399. The genus is placed by Britton and Brown in Melanthaceæ, an order included in the Liliaceæ by Bentham and Hooker. Helonias has a short, stout rootstock like a leek. The allied Heloniopsis is also in the trade.

bullàta, Linn. Swamp Pink. Stud Pink. Lvs. several or numerous, thin, dark green, clustered at the base of the scape, 6–15 in. long, ½–2 in. wide, with fine parallel nerves: scape stout, bracted below. Apr., May. B.M. 747. L.B.C. 10:961. B.B. 1:402.—Int. by H. P. Kelsey.

Helonias, which is perfectly hardy, is so easily propagated by division that it is hardly worth while to grow from seed. Under cultivation, also, it seems to rarely mature perfect seed. It multiplies itself rapidly from offsets, a single plant often providing a dozen others in a season. It is found growing in dense shade and also in the full glare of the sun, always in wet sphagnum bog in the latter case, while in the shade it sometimes spreads to dry ground. Although one of the showiest of all American bog plants, it is comparatively little known here, though better in England. It makes an elegant pot-plant.

Harlan P. Kelsey and W. M.

HELONIÓPSIS (Greek, *like Helonias*). *Liliàceæ*. This includes an herbaceous plant resembling our swamp pink, *Helonias bullata*, in the color of its fls. and stamens, but the fls. are larger and fewer, and the lvs. numerous and tufted. The style in Heloniopsis is a conspicuous feature, being long and red, tipped with a purple undivided stigma, while in Helonias the style is very short and 3-cut. Both genera are separated from numerous allied genera by the septicidal dehiscence of their capsules. The fls. are bell-shaped, drooping, deep pink, 6-lobed, with 6 red filaments and purple-blue stamens. The genus has about 4 species. The following grows in the mountains of Japan at an altitude of 2,000–7,000 ft., and is presumably hardy. It was once offered by John Saul, of Washington, D. C.

Japónica, Maxim. Rootstock short, stout, with long root fibers: lvs. oblanceolate, persistent, green tinged purple: seeds small, very numerous, with a conspicuous tail at each end. B.M. 6986.

HELWÍNGIA (after G. A. Helwing, 1666–1748, a German clergyman, who wrote on the botany of Prussia). *Araliàceæ*. A curious deciduous shrub, remarkable for the reason that the small, inconspicuous greenish fls. are borne in clusters on the midribs of the lvs. at about the center of their upper surfaces. Of not much decorative value and therefore rarely cultivated, but interesting on account of the unusual position of the fls.; tender North. It seems to grow in any soil that is somewhat moist. Prop. by greenwood cuttings under glass. Two species in Jap. and Himal. Fls. diœcious, short-pedicelled, with obsolete calyx, 3-5 petals and stamens and 3-4-celled ovary: fr. a berry-like, 3-4-seeded drupe.

Japónica, A. Dietr. (*H. rusciflòra*, Willd.). Bushy shrub, 3-5 ft. high: lvs. petioled, ovate or elliptic-ovate, acuminate, serrate, stipulate, 1½-3 in. long: fls. in June, the staminate generally with 3, the pistillate with 4 petals. Jap. S.Z. 86. A.G. 13:8.

A. PHELPS WYMAN.

HEMEROCÁLLIS (Greek, *beautiful by day;* because the blossoms close at night). *Liliàceæ.* YELLOW DAY LILIES. This genus includes the Lemon Lily (*H. flava*), which is one of the hardiest and most delightful of all herbaceous perennial plants. It easily ranks among the 50 most popular plants for the home garden. All the blue and white Day Lilies belong to the genus Funkia: all the yellow and orange Day Lilies belong to Hemerocallis. The Yellow Day Lilies have narrow, grass-like foliage, and their flowers have wider funnels. The blue and white Day Lilies have very broad foliage, which is not at all grass-like. The flowers of Funkia are borne in racemes; of Hemerocallis in corymb-like panicles.

Hemerocallis has only 7 species, all of which are cultivated. The plants are all remarkably free from enemies, and need no protection of any kind, even in the severest winters. The roots are bundles of fleshy tubers, and are sometimes classed with bulbs in catalogues of nurserymen. Small plants will flower freely the first year. Clumps can be left undivided for 4 or 5 years without a loss in size or number of flowers, but as a general thing all robust-growing herbaceous perennials should be divided every second year. In old clumps the roots often become firmly matted near the middle, and the wasteful competition between the too-numerous roots weakens the vitality of the plant. Next to *H. flava*, the oldest garden favorites among the Yellow Day Lilies is *H. fulva*, sometimes called Brown Day Lily, and erroneously in some catalogues the Lemon Lily. *H. fulva* is a taller plant, with later and orange-colored fls. and wavy inner segments. Within five years a new species, *G. aurantiaca*, has come into great prominence, and its var. *major* by some connoisseurs is considered the finest of all Day Lilies. As a rule, double forms are not as popular as the types, and for the writer they lack the simplicity and definite character of the single flowers. Yellow Day Lilies have a wholesome fragrance. The individual flowers are short-lived, but there is a good succession. The plants thrive in almost any garden soil, but are most luxuriant along the borders of ponds or moist places, and in partial shade. The flowers are excellent for cutting. Plants prop. by division.

1037. Lemon Lilies—Hemerocallis flava.

R. B. Whyte gives the succession of bloom at Ottawa, Canada, as follows: *H. Dumortierii*, June 4; *minor*, *Middendorfii* and *Thunbergii*, June 11; *rutilans*, June 18: *fulva*, July 2; *aurantiaca*, var. *major*, July 9; *fulva*, var. *Kwanso*, July 23, and *disticha fl. pl.*, July 30. He adds that *H. Dumortierii*, *aurantiaca* var. *major* and *H. rutilans* differ from all others in the fls. being reddish brown outside, which is very marked in the bud.

A. *Fls. fragrant.*

B. *Inner segments of perianth firm: veins not joined by cross veins: color yellow.*

C. *Blossoms in June.*

flàva, Linn. LEMON LILY. Fig. 1037. Lvs. 18-24 in. long, 6-8 lines wide: scapes longer than the lvs.: corymb 6-9-fld.: pedicels 12-24 lines long: tube 6-15 lines long. Europe, temperate Asia. B.M. 19. A.G. 17:437. Gn. 48, p. 400.—In some important works on gardening the color is erroneously given as orange.

CC. *Blossoms in July.*

Thúnbergii, Baker. "Except for its later flowering, Thunbergii does not differ materially from flava." *Baker.* Lvs. 6-7½ lines wide: corymb loose, 8-10-fld., with 1 or 2 fls. lower down: tube nearly 1 in. long: fls. lemon-yellow, opening widely, 3 in. across: segments membranous, crisped. Japan. Int. 1890.—Rare. R. B. Whyte writes that the fls. are not nearly as large as those of *H. flava*, appear in June, and that *H. Thunbergii* differs from all others in having the upper 6 to 10 in. of the scape thickened and flattened.

BB. *Inner segments membranous and wavy at the margin: a few veins joined.*

C. *Lvs. 2-3 lines wide: tube and pedicel long: color of fls. yellow.*

minor, Mill. (*H. graminea*, And., not Schlecht. *H. graminifolia*, Schlecht.). Lvs. 15-18 in. long, darker green than in the other species: scapes about as long as the lvs.: corymb 3-6-fld.: pedicels 3-24 lines long. July, Aug. N. Asia. B.M. 873.

CC. *Lvs. 6-8 lines wide: tube very short: color of fls. orange.*

Dumortièrii, Morren (*H. rùtilans*, Hort.). Height 1½-2 ft.: lvs. 12-15 in. long: scapes hardly as long as the lvs.: corymb 2-3-fld.: pedicels 3-6 lines long: fls. 2-2½ in. long, while they are 3-4 in. long in all the other species; inner segments 5-6 lines wide. Jap. B.H. 2:43. Gn. 31:589.—*H. Sieboldii* is now practically abandoned as a trade name. The yellow-fld. species of this name is *H. Dumortierii*; the blue-fld. species pictured in L.B.C. 19:1869 and P.M. 5:25 is *Funkia Sieboldii*. Var. **flòre plèno** (*H. disticha pleno*, Hort.) is less cult. This species is the earliest to blossom. R. B. Whyte considers *H. rutilans* distinct.

CCC. *Lvs. 8-12 lines wide.*

D. *Color of fls. orange: tube 8-9 lines long.*

aurantìaca, Baker. Height 2½-3 ft.: lvs. more than 12 lines wide: corymb 6-8-fld.: fls. bright orange, opening less widely than any other species. July. Jap. or E. Siberia?—The type was introduced to cult. in 1890 and has rapidly given way to var. **màjor**, Baker, introduced 1895, which is larger in all parts. Lvs. 12-18 lines wide: tube 9 lines long: fls. when expanded 5-6 in. across. July-Sept. Jap. G.C. III. 18:71. Gn. 48:1041 and 50, p. 17. J.H. III. 31:157. A.G. 18:179.—Closest to Dumortierii, from which it is chiefly distinguished by its much larger, later and more reddish fls. and longer tube.

DD. *Color of fls. yellow: tube 5-6 lines long.*

Middendorfii, Traut. & Mey. Name variously misspelled. Height 1-1½ ft.: lvs. 15-18 in. long, 8-12 lines wide: scapes about as long as the lvs.: corymb 2-4-fld.: pedicels almost none: inner segments 9-12 lines wide. Amur region. Gt. plate 522. R.H. 1897, p. 139.

AA. *Fls. not fragrant.*

fúlva, Linn. (*H. disticha*, Don). Lvs. 18-24 in. long, 9-15 lines wide: corymb 6-12-fld.: fls. orange; pedicels short; inner segments with wavy margins, with numerous veins joined by cross veins. July, Aug. Eu., temperate Asia. B.M. 64 (central band of white). Mn. 5, p. 193. Var. **Kwánso** (*H. Kwanso*, Hort.), the "Double Orange Lily," blooms longer than any single-fld. form, according to Meehan. Gt. 500. It has a sub-

variety with variegated lvs. Var. **flòre plèno**, Hort., is shown in F.S. 18:1891, with a red spot on the middle of each segment. Gn. 48, p. 401. R.H. 1897, p. 139. Var. **variegàta** has a stripe of white down the middle of each leaf.
W. M.

HEMICỲCLIA (Greek, *semi-circular;* referring to the scar or furrow on the seed). *Euphorbiàceæ.* This includes a spreading tree, attaining a height of 40 ft., which is cult. in S. Calif. by Franceschi, who values it for its "beautiful holly-like lvs. and red fruits." The genus has about 9 species, natives of India, Ceylon and the Eastern Archipelago, with no near allies of garden value. Trees or shrubs: lvs. alternate, petioled, entire, leathery when full grown: fls. diœcious; petals none; sepals of staminate fls. 4–5, the inner often larger and somewhat petal-like: fr. a globose or ovoid, indehiscent drupe: seed by abortion, usually solitary. *H. Australasica* is told from the other 2 Australian species by its very short filaments and glabrous ovary.

Australàsica, Muell. Arg. Lvs. broadly ovate to ovate-oblong, obtuse, 1⅜–3 in. long, finely veined below: fr. nearly ⅛ in. long, very smooth, red and succulent, enclosing a stone.

HEMIONÌTIS (Greek, *mule;* the plants erroneously supposed to be sterile). *Polypodiàceæ.* A genus of tropical ferns, with copiously netted veins and naked sori following the veins. Eight or 9 species occur in the tropics of both hemispheres. The plants are dwarf, and are grown in Wardian cases by a few fanciers in the Old World. For culture, see *Ferns.*

H. palmàta, Linn. Lvs. palmate, 2–6 in. wide, with 5 nearly equal triangular divisions, those of the sterile lvs. less acute; surfaces pubescent. W. Indies, Mex., S. Amer.—*H. élegans*, Dav. Lvs. 4–10 in. wide, with a broad sinus at the base and 5 long slender, lanceolate divisions: plant smooth. Mex. G.F. 4:485.
L. M. UNDERWOOD.

HEMITÈLIA (Greek, *with half a roof;* referring to sori). *Cyathæàceæ.* A genus of tree ferns of the tropics, with round or semiglobose sori and an inferior indusium, consisting of a scale which is often indistinct and deciduous. Some 20 species occur in both hemispheres. For culture, see *Ferns.*

H. Guianénsis, Hook. Rachis slightly scaly and hispid: lvs. bi-tripinnate, the secondary rachis distinctly winged, especially at the upper portion: sori few in each segment, usually 2–4; indusium ciliate and often lobed. Var. *Paràdæ*, Hort., is the form commonly in cultivation. British Guiana. I. H. 24:280. —*H. Líndeni*, Hook. Lvs. pinnate, the pinnæ distant and slightly stalked, 6–12 in. long, 1–1¼ in. broad, the base truncate or wedge-shaped: sori in 2–3 irregular lines near the margin. Venezuela. I.H. 42:46.
L. M. UNDERWOOD.

HEMLOCK in Old World literature is what we call Poison Hemlock, an umbelliferous herb named *Conium maculatum.* By Hemlock, Americans mean Hemlock Spruce, an evergreen tree, *Tsuga Canadensis.*

HEMP. Common Hemp is *Cannabis sativa* (which see). **Bowstring H.,** see *Sansevieria.* **Manilla H.,** *Musa textilis.* **Sisal H.,** *Agave rigida*, var. *Sisalana.*

HEN-AND-CHICKENS. A proliferous form of the English daisy, *Bellis perennis;* also the thick-leaved rosettes of Cotyledon, used in carpet-bedding and known as Echeveria.

HENBANE. *Hyoscyamus niger.*

HENDERSON, PETER (Plate X.), 1822–1890, market-gardener, florist, seedsman and author, was born at Pathhead, near Edinburgh, Scotland, in 1822, and died in Jersey City, Jan. 17, 1890. He was trained in Old World methods of gardening, came to America in 1843, worked under Geo. Thorburn and Robert Buist, and in 1847 began business in Jersey City as a market-gardener, with a capital of $500, saved by 3 years' hard work. He continued to live there until his death. The publication of "Gardening for Profit" in 1863 marks an era in American horticulture. It was the first American book devoted entirely to market-gardening, and it helped to induce many persons to enter the business. By the time of his death about 150,000 copies of the book are said to have been distributed. It was written in an aggregate of 100 hours, when the author was working 16 hours a day, largely at manual labor. At the noon intervals and late at night he wrote this work lying on his back, with a pillow under his head. The secret of its success, and of the author's, was the invention of new methods adapted to operations on a large scale. The second edition in 1874, and the third in 1887, are both thorough revisions.

"Henderson's Practical Floriculture," 1868, was an epoch-making book in commercial floriculture. Up to this time most works on flower-gardening had been written for the amateur. This point of view is necessarily the commoner one, and Henderson's contribution to it was "Gardening for Pleasure," 1875. In the compilation of "The Handbook of Plants," 1881, he was largely aided by C. L. Allen, and in the second edition, 1890, by W. J. Davidson. "Garden and Farm Topics" was issued in 1884, and in the same year appeared "How the Farm Pays," a stenographic report of conversations between Wm. Crozier and Peter Henderson. It is claimed that nearly a quarter of a million copies of his various works have been sold. His seed business was founded at New York in 1865. Lately more than 200,000 copies of the various catalogues have been distributed annually.

Few men, if any, have done so much to simplify and improve methods of handling plants for commercial purposes. His greenhouses were an object lesson to many visitors, his methods were widely copied, and his business successes were the goal of ambitious market-gardeners and florists, among whom he was for many years the most commanding figure. He was a frequent contributor to the horticultural and agricultural magazines, and during his forty-two years of business life is supposed to have written or dictated at least 175,000 letters. Two-thirds of these letters were written with his own hands, and he always replied promptly to inquiries about methods of cultivation. A self-made man, simple and abstemious in his habits, he was a tireless worker. He combined in a high degree the faculties of growing plants and of business ability. His mastery of details was complete. His books are exceptionally readable, his powerful personality appearing through every page. The records of his personal experience are practical, ingenious and fertile in suggestion. An account of his life is published in a memoir of 48 pages by his son, Alfred Henderson.
W. M.

HÉNFREYA. See *Asystasia.*

HEPÁTICA (*liver-like*, from the shape of the leaves). *Ranunculàceæ.* HEPATICA. LIVER LEAF. A genus of 3 species, natives of the north temperate zone. Stemless, low perennials: lvs. 3-lobed and sometimes toothed; appearing after the flowers and remaining green over winter: scapes 1-fld., with an involucre of 3 small sessile lvs. simulating a calyx: sepals petal-like, white, pink or purple: akenes short-beaked, pubescent. Fig. 1038. The plants prefer shade, but do fairly well in open places. They should remain undisturbed from year to year, in rich, well-drained loam. Well suited to the north or east slope of a rockery. Plants kept in pots in a coldframe until midwinter will quickly bloom at any time desired if removed to a warm room or greenhouse. Prop. by division or seed.

1038. Flower of Hepatica. Natural size.

triloba, Choix. (*Hepática Hepática*, Karst. *Anemòne Hepática*, Linn. *A. triloba*, Hort.). Scapes 4–6 in.: lobes of lvs. obtuse: fls. ½–1 in. across; sepals oval or

1039. Hepatica acutiloba at night.

The flowers of Hepatica droop and close at night.

oblong, obtuse. Earliest spring. Eastern U. S., Eu. and Asia. B. M. 10. B. R. 5:387 (as *H. Americana*). White, blue and pink-fld. forms have been fixed in cultivation, and are known as var. **álba**, Hort.; var. **cærùlea** fl.-pl., Hort.; var. **rùbra** fl.-pl., Hort. Gn. 26:448. G.C. 1873, p. 645 (var. *marmorata*, Moore).

acutíloba, DC. (*H. tríloba*, var. *acùta*, Pursh. *Anemòne acutíloba*, Lamson. *H. acùta*, Britt.). Fig. 1039. Much like *H. triloba*, but with the lobes of the lvs. ovate and acute, occasionally the lateral lobes 2-cleft (rarely the middle one); akenes slightly stipitate. Eastern U. S.

angulòsa, DC. (*Anemòne angulòsa*, Lam.). Plant tufted as in the other Hepaticas, hairy: lvs. 3–5-lobed, lobes often serrate: involucre near the fl. toothed: fls. large, blue, whitish or reddish. Hungary. B.M. 5518. G.C. 1865:698. Gn. 26, p. 25.

K. C. Davis.

HEPBURN, DAVID, was joint author with John Gardiner of the second American book on horticulture. This was published at Washington, D. C., in 1804. The name of Gardiner appears first on the title page, but it may be inferred that the practical experience in the book is almost wholly Hepburn's. He had had 40 years of experience in gardening, half of the time in England and half in America. He was employed by General J. Mason for 6 years on Mason's Island, Georgetown. He had also been employed by Governor Mercer. The book was well made for the time. It is a 16mo, and contains 204 pages of practical directions. The calendar style is used. The first part (100 pp.) is devoted to the kitchen garden. The second part consists chiefly of "Fruits, Flowers, and Shrubs" (82 pp.). This is followed by a few pages on hops, hothouses and greenhouses. The second edition (Georgetown, 1818) contains 348 pages. It includes "A Treatise on Gardening, by a citizen of Virginia." This occupies 80 pages. The copy owned by the Massachusetts Horticultural Society possesses this manuscript note: "This treatise is by John Randolph, of Williamsburg, father of Edmund Randolph, Secretary of State during the administration of General Washington." Robert Manning writes that this note may have been made by General Dearborn. A third edition was published at Washington in 1826, and contained 308 pp

W. M.

HERACLÈUM (named for Hercules, who used it in medicine, according to Pliny). *Umbelliferæ*. This includes 3 hardy herbaceous plants sometimes called Giant Parsley or Giant Cow-parsnip. They are not suited for general gardening, but are sometimes grown in wild gardens or parks, or as single specimens on lawns, where a very bold and striking object is desired. They are coarse herbs, growing 5–6 ft. high, with broad foliage, which is their chief beauty. According to J. Woodward Manning, they are adapted to all soils, but prefer a rich, moist soil, and hence do well at the edge of running water. Manning adds that these plants should never be allowed to go to seed. J. B. Keller writes that if these plants are grown on an open, sunny lawn, they should be liberally supplied with water at all times. Prop. by division or seed. The genus Heracleum has 50–70 widely scattered species and no near allies of garden value.

A. *Plants perennial.*

lanàtum, Mich. Lvs. trisect, tomentose beneath; segments petiolulate, rotund, cordate, lobed: leaflets of the involucel lanceolate: fr. oval-orbicular. N. Amer., W. Asia. Mn. 4, p. 164.

villòsum, Fisch. (*H. gigantèum*, Fisch.). Height 8–12 ft.: lvs. sinuate-pinnatifid, sharply serrate, acuminate, woolly-tomentose beneath; leaflets of involucres short, bristly, deflexed: umbels sparingly rayed: fr. elliptic, ciliate, woolly on the back. G.C. III. 3:437 and 20:271. —Keller says the fls. are nearly white, and borne in Aug. and Sept., in denser umbels than those of *H. Sibiricum*.

1040. The Goose Tree of the herbalists.

AA. *Plant biennial.*

Sibíricum, Linn. Lvs. scabrous to hirsute, pinnate or deeply pinnatifid; segments lobed or palmately parted, serrate: petals about equal: fr. subrotund-oval, deeply notched at the apex. Eu., N. Asia.—Keller says this bears yellowish green fls. in July and Aug. W. M.

HERBA IMPIA of the old herbalists is *Filago Germanica.*

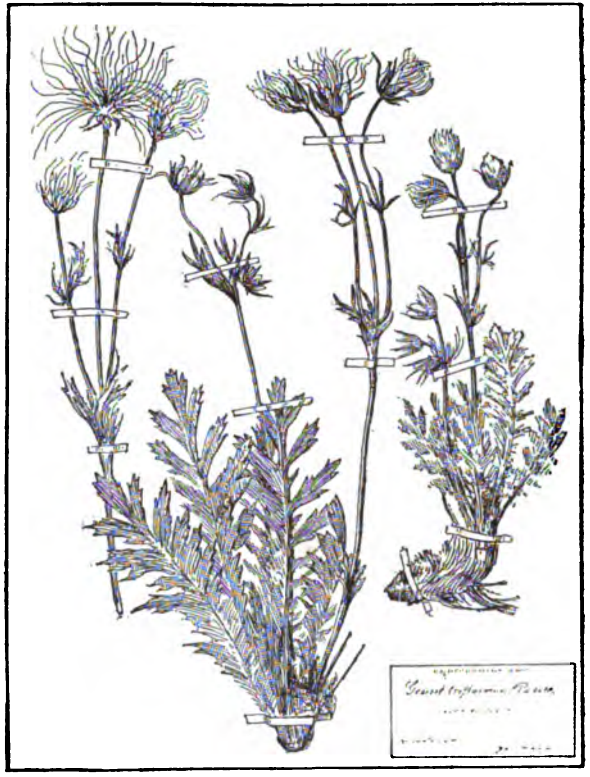
HERBALS. Books on plants, published from the fourteenth to the middle of the eighteenth century, were largely written from the medicinal point of view, and were often called Herbals. The scientific point of view of plant-knowledge is conveniently dated from 1753, when Linnæus published his "Species Plantarum." Of the herbalists, John Gerarde is probably read most at the present time. His style is chatty, quaint and personal. One of the notions accepted by the early herbalists was that of the vegetable lamb, which is pictured in this work under *Cibotium* (Fig. 470). Another idea that fascinated these worthy plant-lovers was that of the barnacle goose tree. Fig. 1040 is reproduced from a book by Duret, 1605, and shows how the fruits that fall upon dry land become "flying birds," while those that fall into the water become "swimming fishes." Other conceptions of this goose tree are reproduced in the Gardeners' Magazine 35:749 (1892). Almost every large library possesses a few Herbals, as Matthiolus, Bauhin, L'Obel and Fuchsius) The largest collection of Herbals in America is the one given by the late E. Lewis Sturtevant to the Missouri Botanical Garden at St. Louis.

HERBARIUM. A collection of dried plants systematically named and arranged. Every horticulturist who takes delight in his profession should have an Herbarium, as it increases immensely the value and pleasure of his work. Every amateur, nurseryman and florist is hereby strongly urged to make a collection of dried specimens of the plants in which he is particularly interested. It need not be expensive nor consume much time, and the process of drying a plant is simple and easy. An Herbarium is like a reference library, and is equally invaluable.

Unfortunately, lovers of cultivated plants rarely care for pressed specimens because they are so lifeless and colorless. Yet there is no surer way for a nurseryman to keep his stock true to name than by making an Herbarium. There are many universities and colleges in America where botanists are glad to verify the names of plants for the sake of the duplicate specimens. This is one of the most practical and useful ways in which botanists and horticulturists can coöperate. The unnecessary waste in time and money caused by confused nomenclature and confused labels is one of the difficulties of a large collection of growing plants.

Even in the largest nursery of hardy plants specimens can be taken by one man in two days in late spring, of everything that is in characteristic condition at that time. Three hundred specimens can be secured in two days in our best nurseries. Even after the spring rush is over there is time to get most of the important spring-flowering plants in flower or fruit, and from that time two or three hours a week is enough to keep up with the procession of flowers. Sometimes interest can be aroused in a young student, who will be glad to do all the work for the sake of duplicates.

Use merchandise tags or a cheap substitute in the form of pieces of paper about 7 in. long, 1 in. wide, with a longitudinal slit a little more than 1 in. long near one end. Pass one end of this piece of paper through the slit, and draw it close about the stem of the plant, leaving plenty of room for the trade name of the plant, the date, and the color of the flowers. It is very useful also to add the height of the plant, and anything else that is not likely to show in a dried specimen. When a basketful is gathered, place each specimen between a folded newspaper page. Each newspaper page, with its inclosed specimen, is then placed between "driers." These are large pieces of felt paper, a kind which is even more absorbent than blotting paper. A hundred driers cost a dollar. Put a board on top of each pile and weight it with stones. Shift the driers daily for a week or so, and then at longer intervals, until the specimens are wholly dry. A better way of drying plants, particularly in a small way, is to use a frame press (to be purchased of dealers in botanists' supplies), provided with cords and straps for tightening the bundle and giving the requisite pressure. Specimens are discouraging looking objects while in press, but when they are carefully prepared and properly mounted on standard size paper (11½ x 16¼ in.), with neat labels giving the name, locality, habitat, date and collector, they not only become attractive but are of great scientific value.



1041. A common method of mounting Herbarium specimens.

The finer and more artistic quality in Herbarium work differs only in the degree of care bestowed at every stage of the process. Some of our elementary botanies give full instructions for making an Herbarium. See, also, the "Horticulturist's Rule Book." Herbaria are notably poor in cultivated plants. For the critical study of garden plants, an Herbarium is a necessity. The sheets are kept in heavy manila paper folders or covers, each genus by itself. The regulation size for this genus cover when folded is 11¾ x 16½ in. Lay the sheets flat (Fig. 1041). Take pains to select specimens which show flowers, leaves and fruits; and herbs should show the roots. WALTER DEANE.

HERBÉRTIA (Wm. Herbert, 1778–1847, Dean of Manchester, distinguished botanist, author of "Amaryllidaceæ," and ardent lover of bulbs). *Iridàceæ.* Seven species of American bulbous plants, with fugitive blue or lilac fls. borne in summer. One species is procurable through Dutch growers. It grows less than a foot high. The bulbs may be started in coldframes. The genus is distinguished by the complete absence of a perianth tube. The showy outer segments are about 1 in. long, and obovate, the inner ones about as long as the stamens. For culture, consult *Bulbs* and *Tigridia.* Mon. by Baker, Irideæ, 1892.

pulchélla, Sweet. Bulb globose, ½ in. thick or more; tunics brown: lvs. about 4, linear, plaited; 3–6 in. long: spathes 1½ in. long: outer segments lilac, with a white claw spotted lilac. Chile. B.M. 3862.

HERB LILIES. *Alstrœmeria.*

HERB OF GRACE. *Ruta graveolens.*

HERB-PARIS. *Paris quadrifolia.*

HERB-PATIENCE. See *Rumex.*

HERB-ROBERT. *Geranium Robertianum.*

HERBS. An Herb is a plant which dies to the ground each year. It may be annual, as bean, candytuft, pigweed; biennial, as mullein, parsnip; perennial, as burdock, foxglove, rhubarb. To the gardener, however, the word Herb is ordinarily synonymous with herbaceous perennial; and he usually has in mind those particular perennial Herbs which are grown for ornament, and which remain where they are planted. Goldenrods, bleeding heart, sweet william, hollyhock, daffodils are examples. To many persons, however, the word Herb is synonymous with Sweet Herb, and it suggests sage and tansy.

Herbs have two kinds of values,—their intrinsic merits as individual plants, and their value in the composition or the mass. It is usually possible to secure both these values at one and the same time. In fact, the individual beauty of Herbs is enhanced rather than diminished by exercising proper care in placing them. Planted with other things, they have a background, and the beauties are brought out the stronger by contrast and comparison. It is quite as important, therefore, to consider the place for planting as to choose the particular kinds of plants. The appreciation of artistic effects in plants is a mark of highly developed sensibilities. Happily, this appreciation is rapidly growing; and this fact contributes to the increasing popularity of landscape gardening and ornamental gardening. Some of the best effects in Herb planting are to be seen in the wild, particularly along fences, roads and streams. In interpreting these native effects, the planter must remember that Herbs are likely to grow larger and more bushy in cultivation than in the wild. He should cover the bare and unseemly places about the borders of his place (Fig. 1042). He may utilize a rock or a wall as a background (Fig. 1043). He may hide the ground line about a post (Fig. 1044) or along a fence. Some of the commonest Herbs are handsome when well grown and well placed. (See Fig. 1045.) Always plant where the Herbs will have relation to something else,—to the general design or handling of the place. This will usually be about the boundaries. The hardy border is the unit in most planting of herbs. See Figs. 1042, 1046. A rockwork Herb border (Fig. 1047) is often useful in the rear or at one side of the premises. Fill some of the corners by the house (Fig. 1048). In remote parts of the grounds, half-wild effects may be allowed, as in Fig. 1049. A pond or pool, even if stagnant, often may be utilized to advantage (Fig. 1050). A good Herb out of place may be worse than a poor Herb in place. But when Herbs are grown for their individual effects, give plenty of room and good care: aim at a perfect specimen (Figs. 1051, 1052). For further hints on related subjects, see *Landscape Gardening;* also *Border.* L. H. B.

1042. An informal Herb border.

1043. Planting against a rock back-ground.

HERBACEOUS PERENNIALS FROM THE LANDSCAPE ARCHITECT'S POINT OF VIEW.—No clear definition can be drawn between herbaceous perennials, biennials and annuals, between Herbs and woody plants, for there are tender Herbs that would in a warmer climate become shrubs or even trees, biennials that become perennials from stolons or offsets, and annuals that become biennials from seed germinating late in the season. Strictly speaking, however, herbaceous perennials are plants having perennial roots with tops that die to the ground annually, such as the columbines, larkspurs, day-lilies, peonies, and most sedges, grasses and ferns. It is customary, however, in publications relating to this class of plants as well as in actual use, to include closely allied species with evergreen foliage, such as statice, yucca, sempervivums and certain pentstemons, together with plants having more or less woody and persistent aboveground stems, such as the suffruticose artemisias and the evergreen creeping species of phlox, veronica, vinca, the iberis, the helianthemums, and many alpine plants, while most bulbous-rooted plants which are true herbaceous perennials are separately classified and grown as bulbs.

Herbaceous perennials are an exceedingly important element of landscape, for they predominate in the mat of grassy or sedgy plants, covering dry or wet open fields and in the surface vegetation under woods and shrubby thickets, either as a grass crop, composed of a comparatively few species cultivated for economic purposes, or as a wild growth made up of many species. The most attractive of these native plants are being cultivated and improved more and more from year to year for ornamental purposes, and are planted in the flower garden, in artificial plantations of shrubbery and in the wild garden. It is to such natives and to exotics of the same class, which are cultivated for a similar purpose, that reference is to be made hereafter.

Fifty years ago nearly every well-to-do family maintained a flower garden, in which there were from 50 to 150 species and varieties of herbaceous perennials, and there were few of the humbler families that did not have a dozen or more species established about their homes. Such plants were distributed by exchange among neighbors and were propagated and offered at retail by dealers, who, however, gradually allowed their stock of plants to run low or abandoned them altogether, until many kinds dropped out of cultivation or were neglected in favor of the tender "bedding out" plants that were brought suddenly into favor by the displays at the Philadelphia Centennial Exposition.

There has been, particularly during the last 15 years, such an increasing interest in herbaceous perennials that there are now offered in the catalogues of American nurserymen and collectors of native plants, nearly 3,000 species and varieties, exclusive of the many garden forms that are distinguished chiefly by the color of their flowers.

In use, the species and varieties of herbaceous perennials may be broadly separated into three groups.

1044. One may hide the ground line with Herbs or Shrubs.

First, plants for the garden that require the favorable conditions of a highly cultivated ground, and careful attention to attain perfection and to persist and increase from year to year. This would include many exotics, some native species and most of the horticultural varieties. Many of such species which would find a congenial place only in the garden have attractive flowers which are so fugitive that they can only be enjoyed on the plant. Other species which are suitable to cut flowers from can hardly be grown in the flower garden in sufficient quantity to liberally meet the floral requirements of the home, and they should be grown in quantity in the kitchen garden or in a special cut-flower garden, for their crops of flowers. Included among plants of difficult cultivation with fugitive flowers are the rock or alpine plants, many of which are offered in European catalogues but few of which will thrive here, and for such as will succeed more favorable conditions are usually found in a well-drained border than in an artificial rockery.

Second, plants for the shrubbery, having aggressive habits, which make them rather objectionable in the flower garden, but fit them to withstand successfully the crowding of shrubs. This class of plants will give variety and prolong the flowering season of shrub borders about lawns, and would be made up chiefly of strong-growing natives and a few of the more persistent exotics.

Third, plants for the wild garden, including the species that require for success some one of the many special conditions prevailing in uncultivated or uncultivable land, or which are so rampant as to require the restraint that some one of these natural conditions will provide. This class of plants would be made up chiefly of natives and a few of the more persistent exotics, and they would be used to enrich groups of native plants under woods, in meadows, streams and ponds and on hedges and poor soil. These are attractive plants that will and do grow successfully under all these conditions without special cultivation, and many of them may be already on the ground. If every plant in a group of natives is watched for at least a year, it will be found that many are so attractive at one season or another that they will be retained and developed in beauty by the gradual removal of the less desirable kinds, for which others that are more desirable may be substituted. (See also the article *Wild Gardening.*)

In arranging plants in new plantations, or in modifying existing plantations in gardens, lawns or woods, much more effective landscape compositions and more agreeable color effects can be secured by using large quantities of a few sorts than by using a few individuals of many kinds. Groups of different species should be selected that will give from period to period during the flowering season effective and dominating masses of foliage and color, and all other plants of the garden which appear at the same time should be made subordinate to these. (Consult, also, the article *Border.*)

Herbaceous perennials are propagated by divisions and from offsets, cuttings and seed. Some kinds, as dictamnus and papaver, may be propagated by root cuttings. The exotic species of gardens and many of the more readily grown natives can be obtained in wholesale quantities from nurserymen. A few exotics and a very large number of attractive native species can be procured in wholesale quantities from collectors of native plants, many of whom also offer nursery-grown plants of the best natives and of a few exotics. The attractive native plants in any region can be transplanted with little difficulty if they are collected with a good sod of earth about the roots. WARREN H. MANNING.

THE CULTURE OF HERBACEOUS PERENNIALS.—A good number of the herbaceous perennials in cultivation are exceedingly easy of cultivation, thriving well in any moderately rich soil of suitable physical condition, and enduring our winter cold and changeableness and summer heat and drought. There are, however, other species which do not grow well in our American climate, except during more moderate seasons or when placed where the climate is locally modified. Whether the plants one desires to grow be easy or difficult of culture, one should aim first of all for a luxuriant growth, for any time or labor saved by poorly preparing the soil, or any money saved by the use of weak or stunted plants, will be regretted later. Unless it is intended to imitate the effect of certain barrens in nature, a garden without luxuriance is lacking in an essential quality.

The preparation of ground for planting consists, in the order of their importance: in making the soil by openness and fineness suitable for root penetration to a depth of from 18 in. to 2 ft.; in providing underground drainage at a depth of at least 2½ ft.; in making the soil sufficiently fertile; and in making the surface soil not liable to "baking."

Depth and physical condition of soil are very important, and should be one's first care. If the season is short and work must be rushed, it is better to omit the manuring and to devote all one's energy to securing a deep feeding area for the roots and a fine physical condition of the soil. In the hardy border the roots of plants are able to penetrate far more deeply into the soil than they do usually in a wild state or in ordinary field culture. This vigor of root growth reaching to good depth, as compared with that of equal vigor but nearer the surface, gives not only greater endurance of drought but aids the plant to

1045. A good effect with Rhubarb.

endure changeableness of weather, and particularly adds to its hardiness. There are many plants which are hardy only if protected until the roots are thoroughly established. This is more often noticed with trees and strong-rooted plants which are able to penetate deeply into the subsoil, but the same applies to herbaceous plants, except that it is usually necessary to loosen the subsoil to ensure penetration by their finer roots to a satisfactory extent. It is not necessary to make the subsoil equal in richness to the upper portion, but it should preferably be mixed with a portion of the surface soil.

1046. A mixed Herbaceous border.

The fine roots are the feeding roots and the surfaces of the soil particles are their feeding ground, so that in making the soil particles smaller the feeding surface in the soil is increased, thus allowing for more roots and making available a greater part of the plant-food in the soil. A fine physical condition can usually be obtained by turning the soil over a few times. No soil should be turned or handled when too moist to crumble, as the clay in the soil is quick to become puddled, and therefore impervious to feeding roots.

Underground drainage is necessary, since roots cannot grow in soil filled with stagnant water. Where the natural subsoil drainage is not sufficient, artificial means should be used. Unless the drainage is good many plants will be injured during the rainier seasons or killed during winter. Plants that are not firmly established are often easily killed by excess of moisture about the roots during their dormant season; for instance, many bog plants otherwise perfectly hardy will winter-kill if planted late in the fall. A further fact showing the effect of water on dormant roots is that many plants, if cut down low enough in the fall to allow water, as from melting snow, to reach the root through the hollow plant stems, will often be entirely rotted by spring. Thus, when it is necessary to destroy goldenrod the dry stems can be mowed in late fall with a sharp scythe. The vulnerability of the root to water coming through the plant-stem may be easily seen by comparing in the spring roots of corn, the stalks of which were cut at different heights the previous fall.

The subject of feeding plants in general is treated at some length under *Fertilizers* and *Fertility*, which see. In the hardy border no large amount of coarse or highly fermentable material should be used. The enrichment of the soil should, if possible, be made while preparing the border, and any fertilizers used should be well mixed with the soil. Even if a liberal amount of stable manure is available, it is well to use some potash or phosphoric acid in connection with it. A light top-dressing of manure given in the fall will keep up the fertility of the soil and afford a slight winter protection, which is appreciated by even the hardiest plants. Over-richness as well as poverty of soil tend to make plants in general less hardy, but usually a great abundance of plant-food should be given, especially for the hardier species, with vigorous constitutions and long season of growth. Many plants having a season of rest in late summer do best in soil not overly rich, especially if the position be moist.

A loose and open surface soil prevents baking after rains and waterings; saves some of the labor necessary to keep the soil open and friable; allows the growth of many smaller, finer-rooted or creeping plants which cannot grow well in a stiff soil; permits the sowing of many annuals in the border. Many low-growing plants are injured on clayey soil by having the under surfaces of the leaves coated with soil by spattering of rain. A clay soil may be made more loose by the addition of manures, sawdust, coal ashes, sand or almost any such material. A light, fine mulch should be kept on the surface of a clay soil.

The points to be borne in mind in planting should be healthy plants, careful planting and sufficient thickness of planting. Plants should be obtained which have not been stunted, as a weakened plant will never make as good a specimen as if rightly treated from the start. When plants are received from the nursery they may be heeled-in if necessary, but every day plants are left where they have no root-hold on the soil is an injury to them, in proportion to the suitableness of the weather for root growth. If plants must remain any considerable length of time before being placed in their permanent position, it is best to plant them in reserve ground, and to remove them when desired with balls of earth.

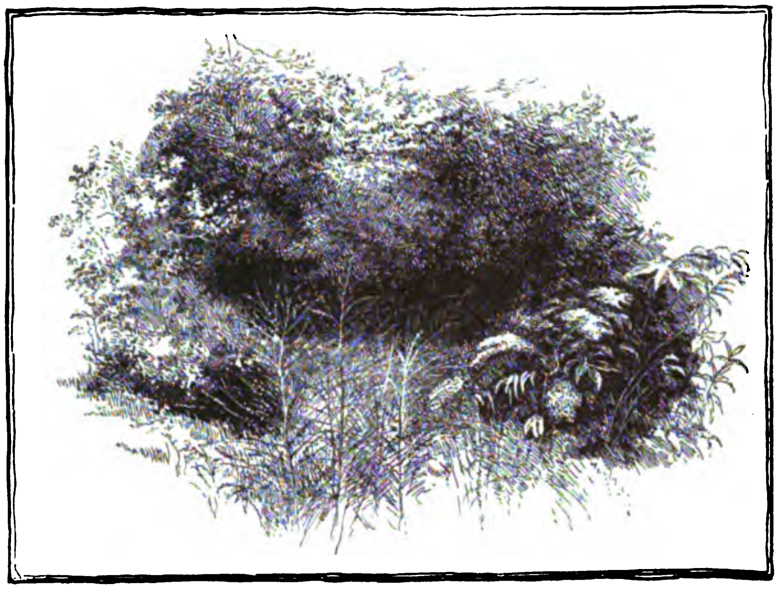
Symmetry of top growth is to some extent, at least, dependent on symmetry of root growth, so that by careful planting the roots not only become more quickly and strongly active, but give us hope for a more symmetrical plant than can be obtained by careless planting. The proper way to place a plant in the ground is equally to distribute the roots about the plant, leaving the tips pointed downward, and then to firm the soil sufficiently about the roots.

A perennial border should be planted rather thick, so that when in foliage it shall appear as one mass. Any showing of soil between plants is not only unnatural, but destroys the beauty of the border as a whole.

Winter Protection of Herbaceous Perennials.—The protection of species not reliably hardy may be accomplished with any material suitable for keeping out frost which is not naturally too moist or close. The material should preferably be heaped over the crown of the plant, to shed part of the rain as well as to prevent quick changes of temperature, or to wholly exclude frost, as the plant may need.

The material to be used will be decided by the plants to be protected, by what is on hand or easily obtainable, and by the presence or not of mice or other vermin, which often work under such material as straw and destroy the plants. Protected plants should be examined

1047. An Herb-covered rock work



1049. A tame-wild corner, Asparagus and Boneset.

during the winter, and if mice are present they may be killed or driven away by placing a few drops of carbon bisulphide in each hole found. (This is also a good way to rid coldframes of these pests. Plenty of ventilation should be given at the time, as the gas evaporated is destructive to vegetation. As the gas is heavier than air, it sinks for the most part down the holes.) If, however, mice are not troublesome, there is no better material for keeping out cold and shedding water than straw. Nature's plan for plant protection is to use the foliage and stems of the plants themselves, the whole ground surface being covered as the weather grows colder with successive coatings of snow, which protection again grows lighter as spring approaches. This is still the ideal winter protection for plants, but snows are likely to disappear in midwinter, and mice are well adapted to live under nature's laws. Where mice are troublesome a light material may be made by composting leaves, manure rakings from lawns, greenhouse waste, weeds not in fruit as pulled during the season, and the like. The material should be earthy enough to keep mice out, and loose enough to permit of easy removal in spring. It should also be loose enough not to hold too much water in winter. Sawdust and charcoal are examples of such material. Most of the plants that are largely cultivated need no protection, but all herbaceous perennials, unless they are evergreen or easily smothered, are benefited by a slight covering to protect the soil from alternate freezing and thawing. When the plants are evergreen a covering to supply shade is often desirable. Other plants, such as *Helianthus decapetalus fl. pl.*, really need protection, not to exclude frost, but to lessen considerably the severity of the winter. Still others, as many of the lilies, are best covered to the exclusion of frost. In general, the plants we endeavor to grow which need complete protection have crowns below the surface, and so may be covered with any amount or kind of material. When it is desired to thoroughly protect crowns on the soil surface, flats may be first placed over the crowns before adding the protection. Late fall plantings should, in almost all cases, be protected to some extent, since plants are less hardy when poorly established in the soil.

1048. A rear corner, embellished with weeds.

Propagation of Herbaceous Perennials.— The methods of propagation most used are by seed, by plant division, and by cuttings.

Propagation by seed is generally not of use for the perpetuation of horticultural varieties, though to a varied extent with different species any variety tends to reproduce its varietal characteristics more perfectly the longer it becomes established as a variety. However, some of our garden plants have been separated into their present number of varieties or forms mainly by continual propagation by seed and plant selection, and such may be satisfactorily increased by seed. An example might be taken in the hollyhock, although, if a group be left to resow itself, or no seed selection be maintained, it will soon become mainly composed of single-flowered plants by reason of their greater seed production. In general, propagation by seeds is satisfactory for all established species and for such varieties and forms as have been thoroughly established either by nature's slow processes or by man's continual selection.

Seed-sowing is not, however, always an easy way to increase many of our garden plants, as there are often a few small items necessary to know concerning a species before success can be assured. Seeds of some perennials remain dormant for a long season after sowing, and, in general, they are very much slower in starting than annuals. Some require more heat than others to germinate, while others require a very cool soil. Many plants brought into cultivation from foreign countries or milder parts of our own land do not produce seed which will remain sound over winter in the soil, nor do seedlings of all hardy perennials withstand the colder season: for instance, *Papaver orientalis*, a hardy plant itself, produces a great quantity of seed which germinates readily as it falls, but the seedlings will not survive the winter unprotected.

A general rule for seed sowing would read: Sow the seed when ripe, and then maintain such conditions of temperature and moisture as the seed would receive in the native habitat of the plant.

Native American plants not from decidedly milder parts and many foreign species may be easily increased by sowing of seed when ripe in the open ground. Among such might be included rudbeckia, aquilegia, coreopsis, monarda, asters (perennial), delphiniums, digitalis, *Dianthus barbatus*, and phlox, all of which will bloom the following season.

Plants generally have one or rarely two particular seasons for blooming, and unless of sufficient size and suitable condition when that season approaches they will wait for its recurrence before showing flowers; so that by sowing seed early in the spring and giving good cultural attention to the plants, we may expect to flower many plants naturally blooming late in the year, or such as are somewhat floriferous at nearly all seasons: for instance, *Lobelia cardinalis* and other lobelias, many native asters, *Gaillardia aristata*, *Bellis perennis*, etc.

The propagation of plants by division is simply the separation of a larger clump of roots and crowns into smaller plants. In the case of plants having buds on the roots, this division may be carried further, and small pieces of the root used to grow other plants.

The separation of plants as practiced in the garden is not usually so much for the purpose of increase as to avoid over-crowding of roots and crowns, with loss of vigor to the plant; for instance, a plant of iris having been undisturbed for a number of years, becomes a tangled circular mat of rootstocks, which in the center cannot find room to grow, and so the plant appears as a large clump of roots, throwing up foliage only on the outer ring. The period during which a plant may remain in any one place without needing separation will vary with the vigor of growth of the plant in each position; for instance, a group of plantain lily in a favorable situation will need separation every two years, while in a poorer place it might remain four. However, the average length of time for a few typical species may be given thus: *Bellis perennis*, pompon chrysanthemums, and other strong-spreading, shallow-rooted and easily established plants do best with yearly separation; *Phlox maculata* and monarda every two years; helianthus, asters and many of the compositæ and *Phlox decussata* about every three years; *Convallaria majalis* and many spring-flowering bulbs every four years; while such plants as peonies may be left for a longer period.

In general, better flowers are obtained from a plant with but one crown than when two or more are left, but unless the new growths are crowding out the central portions or are themselves too numerous to make a vigorous growth possible, division is not necessary. In fact, many plants require a better establishment in the soil than can be given by transplanting or than they can quickly obtain, and such are best undisturbed until quite over-crowded. The question is whether by dividing a plant better flowers and foliage may be obtained than by allowing it to become more thoroughly established.

The time of the year for separation will vary as to the blooming season of the plant; that is, for early-blooming plants late summer or early fall, and for late-blooming plants either late fall or spring, preferably the latter, as many otherwise hardy plants are either weakened or killed if disturbed in the fall.

Propagation by cuttings is rarely useful for the amateur, in the case of herbaceous perennials, but it is an important commercial method. Plants may be obtained from almost any plant having foliage stems by taking a short piece of the growing wood with a bud, either lateral or terminal, and placing the lower end in moist sand or other material suitable for root growth. It is usually necessary to have the lower end of the cutting a node of the stem, and to make the temperature of the material in which it is placed higher than that of the atmosphere (which is the relation of the soil and air in sunshine), and to diminish the evaporation from the exposed parts of the cutting by maintenance of a moist atmosphere and by removal in part of the foliage on the cutting. Some experience will be necessary to know the best temperatures for sand and atmosphere and the most desirable degree of ripeness in the wood to be taken, as they will vary somewhat with species. In general, any cutting of growing wood will form roots in moist sand at a temperature suitable for vigorous root growth of the plant. The increase of plants by cuttings has the advantages of being rapid and of allowing the perpetuation of any variation noticed on a portion of any plant. See *Cuttage*.

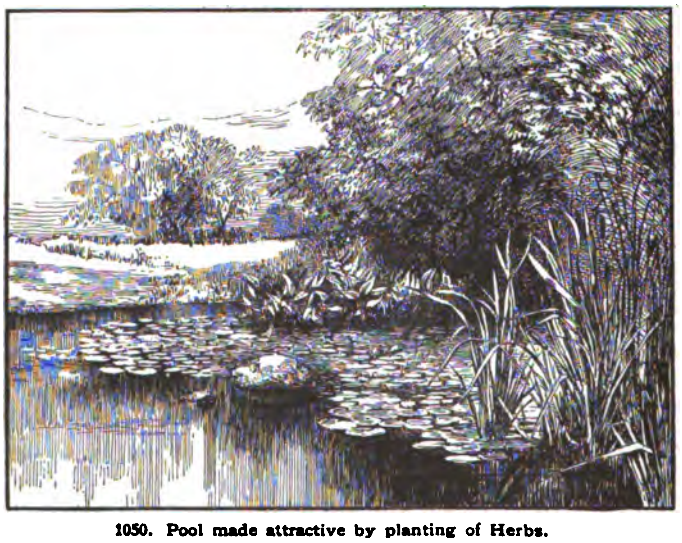
1051. A healthy clump of Joe Pye Weed.

Whichever method of propagation is used, selection of stock for increase should be practiced. If by seed, then the best seed from the best plant should be taken. It is considered by many growers that seeds borne the least number of nodes from the root tend to produce dwarfer and earlier-blooming plants, while the opposite is equally certain. All plants vary, and often the seeds which will produce the most striking variations are the slower to germinate and weaker as seedlings, but any mistreatment of young plants is apt to be against any desirable improvement. The double flowered and highly colored forms of our garden plants are generally the results not only of intercrossing of species or selection, or both, but of intense and perfect culture. A poor, starved plant may not retrograde itself, but it is apt to produce seed which will vary to suit its location.

In propagating by division, the aim should be not only to secure vigorous plants but to select for increase such plants as appear to be the best. Cuttings also should be obtained from selected plants—and the more so since the method is rapid.

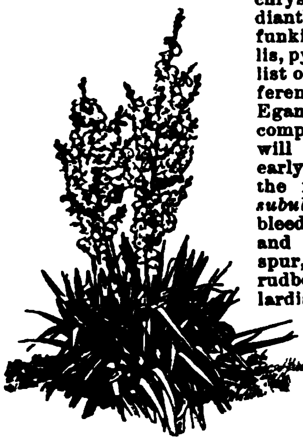
F. W. Barclay.

The Most Popular Kinds.—If all hardy herbaceous perennials were divided into 3 groups, based upon their popularity, the first group would perhaps include 10–12 kinds, the second 30–50, and the third would be too numerous to list in detail. Several of the largest dealers in these plants were asked for such selections, basing their judgment on actual sales and general experience. Replies were received from Ellwanger & Barry, J. Woodward Manning, and the Shady



1050. Pool made attractive by planting of Herbs.

Hill Nursery Co. These reports agree as to the 6 most popular hardy herbaceous perennials. These are anemone, hollyhock, larkspur, iris, peony, phlox. The next 4 favorites are columbine, poppy, rudbeckia and sunflower. These are probably the 10 most popular plants of their class in America. To fill out the list to a dozen, one might choose 2 of the following 10: Campanula, chrysanthemum, coreopsis, dianthus, dicentra, eulalia, funkia, gaillardia, hemerocallis, pyrethrum. The following list of 12 is selected on a different principle by W. C. Egan, who writes that a bed composed of the following will produce flowers from early spring to late fall in the following order: *Phlox subulata*, lily-of-the-valley, bleeding heart, iris (German and Japanese), peony, larkspur, platycodon, phlox (tall), rudbeckia Golden Glow, gaillardia, *Boltonia latisquama*, sunflower. In the South the 12 most popular kinds would make a very different list. P. J. Berckmans writes that the following are hardy at Augusta, Ga., and are probably most popular in the South: Canna, carnation, chrysanthemum, dahlia, violet, verbena, German iris, Japanese iris, funkia, helianthus, phlox, hollyhock.



1052. A good subject—Yucca filamentosa.

An analysis of 4 northern lists gives the following 33 as favorites of the second rank. The agreement would have been much closer if bulbs, grasses and subshrubs had been excluded:

Achillea,
Aconitum,
Alyssum,
Asclepias,
Aster,
Astilbe,
Boltonia,
Campanula,
Dicentra,
Dictamnus,
Digitalis,
Gaillardia,
Geranium,
Gypsophila,
Helenium,
Helleborus,
Heuchera,
Hibiscus,
Iberis,
Kniphofia,
Lobelia,
Lychnis,
Monarda,
Œnothera,
Platycodon,
Ranunculus,
Sedum,
Silene,
Spiræa,
Statice,
Trollius,
Veronica,
Vinca.

W. M.

Selections for Special Purposes.—The following lists are intended to be suggestive, not complete (not all of them in Amer. trade):

1. *For shady places.*—Only those which really need shade are here mentioned. Other important kinds succeed in full sunlight and also in partial shade.

A. *Requiring deep shade.*

Anemone alpina,
" dichotoma,
" nemorosa,
" sylvestris,
Cortusa Matthioli,
Hepatica,
Horminum Pyrenaicum,
Ourisia coccinea (stiff soil).

AA. *Requiring partial shade.*

Actea,
Adonis,
Anemone Apennina,
" Caroliniana,
" ranunculoides,
Arisæma,
Arnebia echioides,
Arum Italicum,
" maculatum,
Calypso (moist),
Goodyera,
Habenaria,
Helleborus,
Liparis,
Lychnis fulgens,
" Haageana,
Omphalodes Luciliæ,
" verna,
Orchis spectabilis,
Phlox divaricata,
Ramondia,
Ranunculus aconitifolius,
Saxifraga,
Tiarella,
Trillium.

2. *For dry places.*—The following will endure extremely dry locations, and are therefore desirable for naturalization. They can endure neglect and drought:

Alyssum,
Antennaria,
Asclepias tuberosa,
Carlina,
Cheiranthus alpinus,
Dianthus arenarius,
Draba.
Erinus alpinus,
Genista sagittalis,
Helianthemum,
Linaria,
Reseda glauca.

The following are desirable for dry situations, but are not as hardy in this respect as the preceding:

A. *Blooming in spring.*

Æthionema,
Anemone Caroliniana,
" nemorosa,
" Pulsatilla,
Cerastium,
Daphne Cneorum,
Erysimum,
Hepatica,
Iberis,
Iris pumila,
Lotus corniculatus,
Saxifraga,
Peony,
Phlox (creeping).

AA. *Blooming in summer.*

Anthemis,
Aquilegia,
Arenaria,
Aster amellus,
Campanula,
Coronilla Iberica,
Cytisus,
Dictamnus,
Eryngium,
Euphorbia corollata,
Galtonia,
Gypsophila,
Heliopsis,
Hieracium,
Inula,
Iris Germanica,
Ononis,
Pyrethrum Tchihatchewi,
Statice,
Yucca.

AAA. *Blooming in autumn.*

Aster,
Calandrinia,
Callirhoë,
Cassia,
Centaurea dealbata,
Coronilla varia,
Corydalis,
Desmodium,
Erodium,
Eulalia,
Geranium Ibericum, etc.,
Helianthemum,
Linum,
Œnothera,
Platycodon,
Sedum.

3. *For moist and wet places.*—In the following subgroups those marked with a star (*) demand the treatment indicated; the others will also thrive with a less degree of moisture:

A. *Near the water's edge.*

Acorus,
Anemone Apennina,
" rivularis,
" Virginiana,
*Butomus,
*Calla palustris,
*Carex riparia,
Iris pseudacorus,
" lævigata,
Monarda didyma,
Myosotis,
Polygonum amphibium.
" Sachalinense,
*Ranunculus aquaticus,
" fluitans,
" hederaceus,
Typha.

AA. *Moist grounds.*

Achillea Ptarmica fl. pl.,
Aconitum,
Anemone alpina,
" palmata,
*Arenaria Balearica,
Arisæma,
Arnica,
Arundo,
Astilbe,
Boltonia,
*Cardamine pratense fl. pl.,
Chelone,
Cimicifuga,
*Corydalis solida,
Dodecatheon,
Funkia,
Helenium,
Lobelia,
Lythrum,
Mertensia,
Phlox divaricata,
Podophyllum Emodi,
Polygonatum,
Polygonum,
Primula,
Pyrethrum uliginosum,
*Saxifraga rivularis,
" umbrosa,
" Virginiensis,
Spiræa,
Trillium,
Trollius.

4. *For carpets and edgings.*—The following are all more or less low and dense:

A. *Blooming in spring*

Æthionema,
Ajuga,
Alyssum,
Arabis,
Armeria (spring to fall),
Asperula,
Aubrietia,
Daphne,
Erysimum,
Heuchera (spring to fall),
Iberis,
Lotus corniculatus,
Phlox amœna,
" reptans,
" subulata,
Polemonium,
Viola cornuta (spring to fall).

AA. *Blooming in summer.*

Achillea Clavenæ,
Arenaria,
Aster alpinus,
Campanula (dwarf),
Dianthus,
Hieracium,
Saponaria,
Silene acaulis,
" alpestris,
" Elisabethæ.

AAA. *Blooming in autumn.*

Achillea aurea,
Armeria,
Erodium,
Helianthemum,
Heuchera,
Ceratostigma Larpentæ,
Silene Shaftæ,
Tunica Saxifraga,
Viola cornuta.

5. *For cut-flowers.*—In the following lists 1 stands for spring, 2 for summer, and 3 for autumn:

A. *Blooming in spring.*

Æthionema,
Alyssum,
Anemone sylvestris,
Astilbe (1–2),
Centaurea montana.
Doronicum,
Hesperis (1–2),
Heuchera (1–3),
Iberis,
Lychnis Viscaria,
Lupinus (1–2),
Myosotis (1–2),
Omphalodes,
Papaver (1–2),
Peony,
Phlox divaricata,
Primula,
Pyrethrum hybridum (1–2),
Pyrethrum Tchihatchewi (1–3),
Ranunculus (1–2),
Spiræa (1–2),
Viola odorata.

AA. *Blooming in summer.*

Anthericum Liliastrum,
Aquilegia,
Campanula,
Centaurea Ruthenica,
Cheiranthus,
Clematis,
Delphinium,
Dianthus,
Eryngium,
Euphorbia,
Gypsophila,
Hemerocallis,
Iris,
Linaria,
Rudbeckia,
Statice,
Thalictrum,
Trollius,
Valeriana,
Veronica.

AAA. *Blooming in autumn.*

Achillea (2–3),
Aconitum (2–3),
Anemone Japonica,
Anthemis tinctoria (2–3),
Arenaria graminifolia,
Aster,
Boltonia,
Cedronella,
Centranthus,
Chrysanthemum maximum (2–3),
Coreopsis (2–3),
Crocosmia,
Gaillardia (2–3),
Helenium (2–3),
Helianthemum (2–3),
Heuchera (1–3),
Lilium (2–3),
Lychnis Flos-cuculli,
" vespertina,
Phlox paniculata,
" suffruticosa,
Platycodon (2–3),
Polygonum affine,
" cuspidatum,
Pyrethrum uliginosum,
Salvia farinacea (2–3),
Saponaria (2–3),
Senecio (2–3),
Stokesia (2–3),
Viola cornuta (2–3).

6. *For bold effects.*—The following have striking and characteristic habit, and are desirable for prominent positions as single specimens or as exclusive groups. Some are foliage plants, the flowers being inconspicuous or not to be counted upon. Tall means 5 ft. or more; the others are of medium height, 2–4 ft.:

A. *Flowers incidental.*

Acanthus,
Arundo (tall),
Bamboos,
Elymus (tall),
Ferula,
Gunnera (tall),
Heracleum (tall),
Polygonum (tall).

AA. *Flowers more or less conspicuous.*

B. *Tall.*

Bocconia,
Cephalaria,
Cimicifuga,
Crambe,
Erianthus,
Eulalia,
Helianthus orgyalis,
Rudbeckia Golden Glow.

BB. *Medium.*

Anemone Japonica,
Bamboos,
Clematis recta,
Dictamnus,
Funkia,
Ligularia,
Symphytum (variegated),
Yucca.

7. *For forcing and greenhouse decoration.*—The following are good subjects for potting. Helleborus and Saxifraga can be forced for Christmas. Those in the first list can be forced for Easter. Those in the second list are desirable for indoor decoration between Easter and the burst of spring outdoors:

A. *For forcing.*

Alyssum,
Arabis,
Astilbe,
Cheiranthus alpinus,
Dianthus,
Funkia (variegated),
Heuchera sanguinea,
Iberis,
Lychnis Flos-cuculli,
Lychnis Viscaria,
Saxifraga,
Peony,
Polygonatum multiflorum,
Primula,
Spiræa.

AA. *For indoor decoration.*

Acorus gramineus,
Aster alpinus,
Aubrietia,
Campanula,
Dodecatheon,
Hepatica,
Myosotis,
Phlox amœna,
" reptans,
" subulata.

J. B. KELLER.

HERBS, ORNAMENTAL. See *Herbaceous Perennials.*

HERBS, POT. See *Greens.*

HERBS, SALAD. See *Greens* and *Salad Plants.*

HERCULES' CLUB. *Aralia spinosa.* Also *Zanthoxylum Clava-Herculis.*

HERMODÁCTYLUS (Greek, *Mercury's fingers;* from the arrangement of the tubers). *Iridàceæ.* SNAKE'S-HEAD IRIS. This is a hardy tuberous plant closely allied to Iris, the fls. purplish black and green, of a quaint and peculiarly attractive beauty. The plant is procurable from Dutch and Italian growers. The genus differs from Iris only in the 1-celled ovary with 3 parietal placentæ; Iris has a 3-celled ovary.

tuberòsus, Salisb. (*Iris tuberòsa,* Linn.). Tubers 2–4, digitate, 1 in. long: stem 1-fld., 1 ft. or more high: lvs. 2–3, glaucous, 4-angled, 1–2 ft. long: outer perianth segments 2 in. long, dark purple; inner ones green. Apr. B.M. 531. F.S. 11:1083. G.C. II. 23:672.

J. N. GERARD.

HERNÁNDIA (Francisco Hernandez, physician to Philip II of Spain, traveled in West Indies 1593–1600, and wrote on natural history of Spain). *Lauràceæ.* JACK-IN-A-BOX. This includes *H. ovigera,* a tree from Mauritius, which grows 40 ft. high, and is cult. in S. Calif. by Franceschi, who says it has light green, glossy lvs. with a red spot in the center, and large, whitish, egg-shaped fruits. The genus has 9 widely scattered species of tropical trees: lvs. alternate, entire, ovate or peltate, 3–7-nerved: fls. in a loose panicle, the extreme branches terminated by a 4–5-bracted involucre. Of the 3 fls. in an involucre, the central one is pistillate and sessile, the lateral ones staminate and pedicelled. *H. sonora,* Linn., from India, is much used in Europe for subtropical bedding, and produces a juice that removes hairs from the face without pain. Its staminate fls. have their parts in 3's or 4's and the filaments have one gland at the base, while in *H. ovigera* the floral parts are always in 3's and there are two glands at the base of each filament. *H. sonora* has peltate or cordate lvs. 7–12 in. long and 4–6 in. wide.

ovigera, Linn. Lvs. 6–7 in. long, 4½–6 in. wide, oblong, acuminate, palminerved: fr. an egg-shaped drupe, borne on a stalk and obscurely ribbed.

HERNIÀRIA (Greek; supposed to cure hernia or rupture). *Illecebràceæ.* HERNIARY. RUPTURE-WORT. This includes a hardy herbaceous perennial plant, which grows about 2 in. high and produces inconspicuous greenish fls. in summer. It makes a dense mat of moss-like foliage, which turns a deep bronzy red in winter. It is much used in carpet-bedding and to a less extent in rockeries and for edgings of hardy borders. Recommended for covering graves. It thrives in the poorest soils, makes a solid covering, and is by some regarded as one of the most valuable of hardy trailers. Prop. by division or seed. Grows wild in England, and is kept in many large collections of hardy plants.

The genus has 8–23 species, which are widely scattered, but all grow in sandy places, chiefly near the sea. It has no near allies of great garden value, but 2 species of Paronychia are cult. for the same purpose and are easily told apart by general appearance. Herniaria and Paronychia are alike in their 5-parted perianth and 2 stigmas, but in Herniaria the segments are blunt, while in Paronychia they are hooded near the apex and have a horn or small sharp point on the back near the apex. Herniaria is composed of annuals or perennials with roots of short duration, and they are all much branched, trailing plants, either glabrous or hirsute: lvs. opposite, alternate or clustered, small, entire: fls. minute, crowded in the axils; sepals, petals and stamens 5: seed solitary.

glàbra, Linn. Lvs. obovate, rarely orbicular, glabrous except a few hairs at edges, which are usually recurved: fls. in a leafy spike or the lower ones at considerable intervals. July, Aug. Eu., Asia.

W. M.

HESPERÁNTHA (Greek, *evening flower*). *Iridàceæ.* Twenty-six species of Cape bulbs, 3 of which are procurable from Dutch growers. They belong to the Ixia tribe and are much inferior to Ixias for general cultivation, but have fragrant flowers, opening at evening. The genus is still more closely allied to Geissorhiza, and differs only in having longer style-branches and spathe-valves always green instead of sometimes brownish above. The corms are ½ in. thick or less: lvs. 2–5: fls. 2–10 in a lax, distichous spike; inner segments white; outer ones red outside. For culture, see *Ixia* and *Bulbs*. Mon. by Baker in Irideæ, 1892, and in Flora Capensis, vol. 6, 1896–7.

A. *Foliage hairy.*

pilòsa, Ker. Corm globose: lvs. 2, linear, erect, strongly ribbed, 3–6 in. long: outer segments claret-red. B.M. 1475 (outer segments speckled with color).

AA. *Foliage not hairy.*

B. *Lvs. spreading, 2–3 in. long.*

falcàta, Ker. Corm conic: lvs. 2–4, lanceolate: outer segments claret-red. B.M. 566, as *Ixia falcata*.

BB. *Lvs. erect, 4–6 in. long.*

graminifòlia, D. Don. Corm globose: lvs. 3–5, linear: outer segments reddish brown. B. M. 1255, as *Geissorhiza setacea*.

HÉSPERIS (Greek, *evening*, same root as vesper; flowers more fragrant at evening). *Cruciferæ.* This includes the Dame's Rocket, a vigorous, hardy herbaceous perennial plant, forming clumps 2–3 ft. high, branched from the base, and covered with showy terminal pyramidal spikes of 4-petaled flowers, resembling stocks. The colors range from white through lilac and pink to purple. The double forms are most popular. Rockets bloom from June to Aug., and have long been cult. in cottage gardens. J. B. Keller writes: "The ordinary single forms are not worth growing in the border, but may be used in wild gardens. The double Rockets are considered amongst the best hardy plants, being very productive of bloom and extremely useful for cutting."

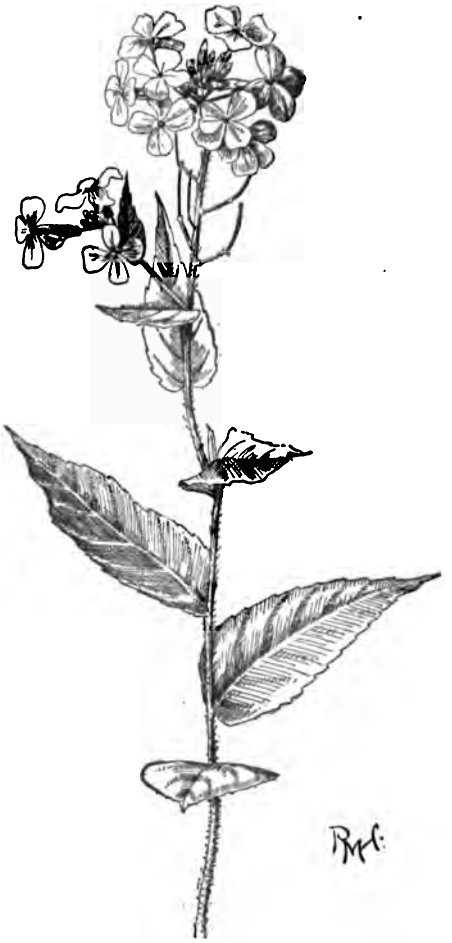
The genus has about 20 species in Europe, Asia Minor and Siberia. Herbs, biennial or with a stem that is perennial at the base, pilose, the hairs simple, forked or glandular: stem-lvs. usually sparse, ovate or oblong, entire, dentate or lyrate: fls. in loose racemes, often fragrant; petals 4, long-clawed: pods long, linear, cylindrical: seeds numerous, winged or not. The genus is allied to the stocks, but has a somewhat different habit and the hypocotyl incumbent not accumbent.

matronàlis, Linn. ROCKET. SWEET ROCKET. DAME'S VIOLET. DAMASK VIOLET. Fig. 1053. Lvs. ovate-lanceolate, 2–3 in. long, toothed: pods 2–4 in. long, straight, much contracted between the seeds. Eu., N. Asia. Escaped from gardens in Eng. Gn. 53, p. 293 and 49, p. 339 (a lovely garden view). W. M.

HESPEROCÁLLIS (Greek, *evening beauty*). *Liliàceæ.* This genus of only one species belongs to the group of desert plants of the Lily family, of which the common *Yucca filamentosa* is the best hardy type. It is a native of Colorado, and is also said to grow in Calif. and Mex. Franceschi writes that the large, waxy white or greenish fls. are very fragrant, and that the bulb should be deeply planted in perfectly drained soil. This genus, like Yucca and Cordyline, has an indefinite number of ovules in each cell, while in Dracæna the ovules are solitary and in Dasylirion 3 in each cell. Hesperocallis bears its fls. in an unbranched raceme, while the other genera named here bear their fls. in panicles. All have woody stems. Other important generic characters of Hesperocallis are the funnel-shaped perianth and the loculicidal dehiscence of the capsule.

undulàta, Gray. Bulb large, corm-like: stem stout, 1–2 ft. high, 5–8-fld.: lvs. linear, fleshy, keeled, 3–6 lines wide, wavy margined: fls. 1½–2 in. long; segments 5–7-nerved.

HESPEROCHÌRON (Greek, *hesperos*, originally evening, but here western, i. e., in the direction of the setting sun, and *Chiron*, a çentaur distinguished for his knowledge of plants; hence "Western Centaury," these plants being at first placed in the Gentian family). *Hydrophyllàceæ.* A genus of 3 species of northwest American tufted perennial herbs with scapes bearing solitary, rather large whitish fls. The nearest allied genera of garden value are Phacelia and Emmenanthe, which are very distinct in color of fls., general appearance and cymose inflorescence. It is still doubtful whether Hesperochiron is in the right order. Dwarf, stemless perennials or possibly biennials: lvs. entire, spatulate or oblong: fls. purplish or nearly white, with parts normally in 5's, rarely in 6's to 7's; style 2-cut; capsule 1-celled, loculicidal, 15–20-seeded: seeds minutely netted or wrinkled. Procurable through Californian specialists and collectors.



1053. Dame's Rocket or Sweet Rocket—Hesperis matronalis (× ½).

A. *Corolla lobes shorter than the tube.*

Califórnicus, Wats. Lvs. numerous: corolla somewhat oblong, bell-shaped. Hills and meadows. B.R. 10:833 (as *Nicotiana nana*).

AA. *Corolla lobes longer than the tube.*

pùmilus, T. C. Porter. Lvs. fewer: corolla nearly wheel-shaped; tube densely bearded within. Springy and marshy grounds in mountains. W. M.

HESPEROSCORDUM. Consult *Brodiæa.*

HETEROCÉNTRON. See *Heeria.*

HETEROMÈLES is included in *Photinia.*

HETEROPÁPPUS (Greek, *two kinds of pappus*). *Compósitæ.* This includes a plant that lovers of our native Asters and Boltonias should not neglect. It is a hardy herbaceous perennial plant that bears azure-blue aster-like fls. in summer. The genus is closely related to Aster, having the habit of the Asters of the section Calimeris. The plant in the trade is known as *Calimeris Tatarica.* Heteropappus is closely related to Boltonia and is not far from Callistephus, which contains the China Asters. The chief botanical distinction resides in the pappus, which in the large group containing Callistephus and Aster is composed of numerous bristles arranged in one or more series, while Boltonias and Heteropappus belong to a group in which the pappus is anomalous. In Boltonia it is composed of very short, somewhat chaffy bristles, with the addition usually of 2–4 awns not longer than the akene. In Heteropappus the pappus of the rays is composed of very short, somewhat chaffy bristles, while in the disk-fls. it consists of numerous slender bristles arranged in 1 or 2 series.

Heteropappus is a genus of 2–4 species from Japan and China. Herbs, erect, branched above: lvs. alternate, entire or coarsely toothed: heads in loose irregular panicles or solitary at the tips of branches: rays white or sky blue. See *Calimeris.*

híspidus, Less. (*Calímeris Tatárica*, Lindl.). Stem roughish: lvs. linear, acute, pubescent: branches spreading, usually unbranched and bearing 1 head: involucral scales acuminate, hirsute, herbaceous, not white-margined. Japan. Sandy places of Mongolia.

HETEROPHRÁGMA (Greek, *an odd kind of capsule*). *Bignoniàceæ.* This includes a tropical tree that is very rare in cultivation. It grows 30–50 ft. high, with 5–7 leaflets, which are 7–9 in. long and about 5 in. wide, and swelling-tubular 5-lobed fls. 2 in. wide and densely woolly outside. The plant was once offered in this country as *Bignonia adenophylla*, but Bignonia belongs to a tribe in which the dehiscence of the capsule is septifragal or septicidal, while Heterophragma belongs to a tribe in which the dehiscence is loculicidal. Heterophragma is a genus of 3 species of trees from India and Africa. Lvs. opposite, arge, pinnate: fls. rosy, yellow or orange, glabrous or tomentose outside; calyx irregular, 3–5-lobed during anthesis: capsule long, cylindrical or compressed, falcate or twisted, loculicidally 2-valved; septum flat or 4-angular: seeds winged on both sides.

adenophýllum, Seem. (*Bignònia adenophýlla*, Wall.). Leaflets broadly elliptic, pubescent when mature: fls. brownish yellow, densely woolly: capsule cylindrical, twisted, 1–3 ft. long, 1 in. wide, resembling a cork screw. India.

HETEROSMÌLAX (Greek, *another kind of Smilax*). *Liliàceæ.* This includes an ornamental climber with the habit of Smilax, but the perianth is undivided (instead of 6-parted, as in Smilax) and the mouth is minutely dentate. It resembles Smilax in having diœcious fls., borne in umbels and tendril-bearing stalks. The genus contains 5 species of woody climbers from India, Malaya, China and Japan: lvs. 3–5-nerved: fls. small or very small. Latest monograph in Latin in DC. Mon. Phan 1:41 (1878).

Japónica, Kunth. Lvs. with stalks about ½in. long, blades about 4–5 in. long: staminate fls. unknown. Japan, where it is cult. for the roots, which are used in medicine.

HETEROSPÀTHE (Greek, a *different kind of spathe*). *Palmàceæ.* Also written *Heterospatha.* A genus of only 1 species, native of the small island of Amboyna, the Dutch headquarters in the East Indies. It is said by Sander and Co. to be a rare and highly ornamental palm, with graceful, spreading habit and pinnatisect leaves, the segments being long, slender and tapering. Its nearest allies of garden value are Verschaffeltia and Dypsis, in which the stigmas are basilar in fruit, while Heterospatha belongs to a group in which the stigmas are eccentric or lateral in fruit. Other important generic characters are the 6 stamens with versatile anthers and the 1-celled ovary. The plant is procurable from importers and from S. Fla.

elàta, Scheff. Tall, unarmed: lvs. terminal, long-petioled, equally pinnatisect; segments numerous, lanceolate, narrowed at both ends, acuminate, 1-nerved, margins thickened and recurved at the base; rachis round on the back, flat on the face; sheath short, fibrous, swelled at the base: spathes 2, the lower 2-crested, the upper much longer. A very worthy palm.

HEÙCHERA (Johann Heinrich von Heucher, 1677–1747, professor of botany at Wittenberg). *Saxifragàceæ.* This includes *H. sanguinea* which probably ranks among the half-dozen best plants with small, red flowers. It is very desirable for the hardy border, where it blooms from spring to late fall. It is also useful to florists for cut-flowers and for forcing. All the Heucheras resemble our dainty wild flower, the Bishop's Cap (Mitella) in their habit, as they have a tuft of heart-shaped, 5–9-lobed, crenate leaves, from which spring a dozen or so slender scapes a foot or more high with small fls. borne in panicles, giving a delicate and airy effect.

Heuchera belongs to a group of genera including Mitella and Tiarella, in which the ovary is 1-celled. In Heuchera the petals are 5 or 0, and entire; in Mitella 5. 3-fid or pinnatifid; in Tiarella 5 and entire. Heuchera has 5 stamens; Mitella 5 or 10; Tiarella 10. The capsule of Heuchera is inferior, 2-beaked; in Mitella superior, not beaked; in Tiarella superior, compressed. Heuchera has about 20 species, all North American and ranging from Mexico to the arctic regions.

The attractive and petal-like portion of *H. sanguinea* is the calyx, the petals being small in all Heucheras (often shorter than the calyx). The other species are attractive by reason of their general habit, and particularly the graceful, open panicle. *H. sanguinea* came into prominence about 1884 and is now, according to J. B. Keller, one of the most popular of hardy perennials. The others are procurable from the largest dealers in native plants and from western collectors. They range from 3 in. to 3 ft. high, averaging about 1½ ft., and bloom in summer, having greenish white or purplish fls. J. B. Keller writes that almost any good garden soil suits them, and that they are not particular as regards exposure to sunlight (though an open situation is preferable), and that they look well in borders, rockeries, separate beds and elsewhere. Prop. by division or seed.

A. *Stamens and styles included (or in H. pubescens scarcely exserted).*

B. *Scapes hairy.*

C. *Inflorescence a panicle.*

D. *Calyx not prominently oblique, i.e., the lobes equal or nearly so.*

E. *Margin of lvs. pointed, with distinct teeth.*

sanguínea, Engelm. CORAL BELLS. CRIMSON BELLS. Height 1–1½ ft.: scapes pilose below, glandular pubescent above: fls. typically bright red, but in horticultural varieties ranging from white through pink and rose to dark crimson. New Mex., Ariz. The best pictures are B.M. 6929, Gn. 26:463. Others are Gt. 45, p. 577. I.H. 43, p. 334. Mn. 8, p. 75. A.G. 17:201. R.H. 1898, p. 431. R.B. 22, p. 246. S.H. 2:120. G.C. III. 4:125. P.G. 4:35. Var. **álba** (*H. álba*, Hort.) has pure white fls., and was int. about 1896 by Haage & Schmidt. Var. **spléndens**, int. 1898 by the same firm, has dark crimson fls. Var. **robústa**, or **grandiflòra**, Hort., according to J. B. Keller, is an improvement on the type, the bells being larger and the color brighter. Var. **hýbrida** ("Rosy Morn"), Hort., according to D. M. Andrews, is "more robust than the type, foliage deeper cut and the divisions more pointed: fls. rosy pink." Andrews adds that var. **álba** comes true from seed.

EE. *Margin of lvs. with crenations merely acute or blunt.*

pubéscens, Pursh (*H. ribifòlia*, Fisch. & Avé-Lall.). Height 9–12 or 15 in.: scapes densely glandular pubescent, at least above. Rich woods, Mts. of Penn. to N.

C. B.B. 2: 179.—"Evergreen foliage marbled with bronzy red."—*Woolson.*

DD. *Calyx prominently oblique.*

hispida, Pursh. Height 2–4 ft. Woods, Va. to Idaho. B.B. 2:180.

CC. *Inflorescence a spike.*

cylíndrica, Dougl. Height 10–24 in. Yellowstone Park westward. B.R. 23:1924.

BB. *Scapes not hairy.*

C. *Inflorescence a loose panicle.*

parvifòlia, Nutt. Height ½–2 ft. New Mex. to Mont.

CC. *Inflorescence denser, spicate.*

bracteàta, Ser. Height 3–6 in. Colo.

AA. *Stamens and styles much exserted, at least at first.*

B. *Length of calyx 3–5 lines.*

rubéscens, Torr. Height 8–15 in.: scape usually leafless, glabrous or somewhat scabrous: margin of lvs. ciliate. New Mex. to Nev.

BB. *Length of calyx 1½–3 lines.*

Americàna, Linn. ALUM ROOT. Height 2–3 ft.: scape leafless or with a few small lvs., more or less glandular-hirsute. Dry or rocky woods, Ont. to La. and Minn. B.B. 2:179. R.H. 1898, p. 431.—"Has mottled foliage."—*Gillett.*

BBB. *Length of calyx 1–1½ lines.*

C. *Scape villous, i. e., densely covered with long, soft hairs.*

villòsa, Michx. Height 1–3 ft.; scape mostly leafless. Rocky places, Va. to Ga. and Tenn. B.B. 2:179.

CC. *Scape thinly covered with minute glandular hairs.*

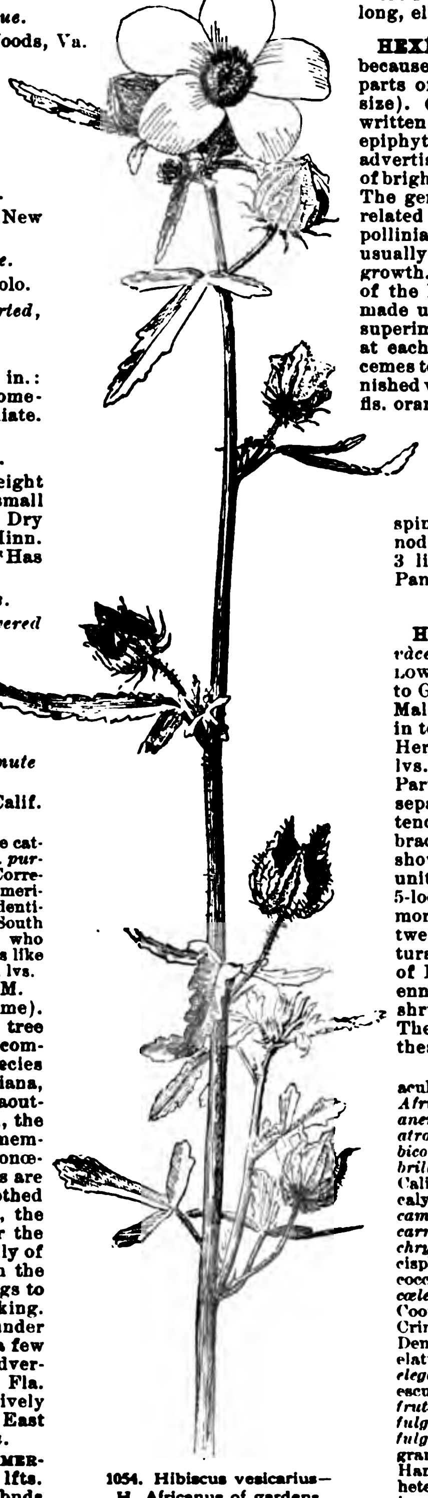
micrántha, Dougl. Height 1–2 ft. Calif. B.R. 15:1302. R.H. 1898, p. 431.

The following names are seen in trade catalogues but not in Index Kewensis. *H. purpuráscens* was advertised 1898, by H. Correvon, Geneva, Switzerland. Plants in American trade are not yet large enough for identification.—*H. Wheèleri* was found in the South some years ago, and Thomas Meehan, who has not examined it closely, says it looks like a form of H. Canadensis with variegated lvs.

W. M.

HÈVEA (from the Brazilian name). *Euphorbiàceæ.* This includes the tree that produces the Para rubber of commerce. The genus contains 11 species of tall trees from Brazil and Guiana, furnishing the milky juice called caoutchouc: lvs. alternate, long-stalked, the 3 leaflets entire, feather-veined, membranous or leathery: fls. small, monœcious. Important generic characters are the 3 leaflets, loose panicles, 5-toothed or 5-lobed calyx, and 5–10 stamens, the filaments united in a column under the rudimentary ovary. The nearest ally of garden value is Jatropha, in which the fls. have petals, while Hevea belongs to a group in which the petals are lacking. This plant may possibly be cult. under glass for its economic interest in a few botanical collections. It was once advertised by Reasoner Bros., Oneco, Fla. The common "rubber plant," extensively cult. North as a house plant, is the East India Rubber Plant, *Ficus elastica.*

Brasiliénsis, Muell. Arg. SOUTH AMERICAN RUBBER TREE. Height 60 ft.: lfts. membranous: staminate fls. with buds narrowly ovoid-conical and disc small, urn-shaped, many-lobed, tomentose; anthers 10, in 2 whorls: floral lfts. 2–3 in. long, elliptic-lanceolate. Brazil.



1054. Hibiscus vesicarius—H. Africanus of gardens. (× ½.)

HEXÍSEA (Greek, *six equal things;* because the attractive and bright colored parts of the flower are 6, and of equal size). *Orchidàceæ.* Should have been written *Hexisia.* This includes a small epiphytic plant which John Saul once advertised as "bearing profuse panicles of bright vermilion flowers twice a year." The genus belongs to a subtribe closely related to Epidendrum but with different pollinia. Stems terete or angled, with usually 2 lvs. at the apex of each annual growth. New growths arise in the axils of the lvs., the entire stem being thus made up of long, fusiform, apparently superimposed pseudobulbs, with 2 lvs. at each node. Lvs. few, narrow: racemes terminal, the short-peduncled furnished with overlapping, leathery scales: fls. orange or purple; anthers semi-globose; pollinia 4, in 1 series. Four species, ranging from Mexico to Guiana.

bidentàta, Lindl. Height 6–8 in.: stem branched, forming spindle-shaped, many-grooved internodes: lvs. in pairs, 2–4 in. long, 3 lines wide, channelled, notched. Panama. B.M. 7031. G.M. 37:19.

H. HASSELBRING.

HIBÍSCUS (old Latin name). *Malvàceæ.* MARSH MALLOW. ROSE MALLOW. A polymorphous genus, allied to Gossypium, Abutilon, Althæa and Malva, the species widely distributed in temperate and tropical countries. Herbs or shrubs, or even trees, with lvs. palmately veined or parted. Parts of the fl. in 5's; calyx gamosepalous, 5-toothed or 5-cleft, subtended by an involucel of narrow bracts; corolla usually campanulate, showy, of 5 distinct petals; stamens united into a 5-toothed column: ovary 5-loculed, bearing 5 styles: fr. a dry, more or less dehiscent capsule. Between 150 and 200 species. Horticulturally, there are four general groups of Hibiscus—the annuals, the perennial border herbs, the hardy shrubs, and the glasshouse shrubs. The culture and treatment vary with these groups.

INDEX.

aculeatus, 6.
Africanus, 1.
anemonæflorus, 13.
atrorubens, 13.
bicolor, 13.
brilliantissimus, 21.
Californicus, 11.
calycinus, 18.
camellæflorus, 13.
carminatus, 21.
chrysanthus, 18, 21.
cisplatinus, 19.
coccineus, 7.
cœlestis, 13.
Cooperi, 21.
Crimson Eye, 9.
Denisoni, 20.
elatus, 15.
elegantissimus, 13.
esculentus, 4.
frutex, 13.
fulgens, 21.
fulgidus, 21.
grandiflorus, 12.
Hamabo, 14.
heterophyllus, 17.
incanus, 10.
kermesinus, 21.
lasiocarpus, 11.
Leopoldii, 13.
luteus, 21.
Manihot, 5.
militaris, 8.
miniatus, 21.
Moschentos, 9.
mutabilis. See Suppl. list.
pæoniflorus, 13.
palustris, 9.
purpureus, 13.
ranunculæflorus, 13.
Rosa-Sinensis, 21.
Rosella, 3.
roseus, 9.
ruber, 13.
Sabdariffa, 3.
Sinensis, 21.
speciosus, 7, 13.
sub-violaceus, 21.
Syriacus, 13.
tiliaceus, 16.
totus albus, 13.
Trionum, 2.
vesicarius, 1.
violaceus, 13.
zebrinus, 21.

A. *Annuals.*

B. *Plant low and diffuse.*

1. **vesicàrius**, Cav. (*H. Africànus*, Hort.). FLOWER-OF-AN-HOUR. BLADDER KETMIA. TRAILING HOLLYHOCK. Fig. 1054. A foot or 2 high, bushy-spreading, the main branches becoming prostrate, usually hispid-hairy: lvs. 3–5-parted, the upper ones 3-parted, with the middle lobe much the largest, the lobes linear-oblong or sometimes widening upwards, coarsely notched, the root-lvs. undivided: fls. solitary in the upper axils, opening wide in the sunshine but closing in shadow, 1–3 in. across, sulfur-yellow or white, usually with a brown eye; pedicel elongating in fr., and the calyx becoming much inflated. Cent. Afr.—An interesting annual, blooming freely throughout the hot weather of summer, and thriving in any open, warm place. Seeds are usually sown where the plants are to stand. Excellent for rockwork.

2. **Triònum**, Linn., to which the above species is usually referred, has much wider and more spatulate and relatively shorter leaf-lobes, which are round-toothed or lyrately lobed: fls. smaller. From S. Eu. and Afr. B. M. 209.—Sometimes a weed about cult. grounds.

BB. *Plant mostly tall, strict and stout.*

3. **Sabdariffa**, Linn. (*H. Rosélla*, Hort.). JAMAICA SORREL. ROSELLE. Strong, 5–7 ft. high, nearly glabrous, the stems terete and reddish: root-lvs. ovate and undivided, the upper ones digitately 3-parted, the side lobes sometimes again lobed; lobes lanceolate-oblong and crenate dentate: fls. solitary and almost sessile in the axils, much shorter than the long leaf-stalks; calyx and bracts red and thick, less than half the length of the yellow corolla. Old World tropics.—Widely cult. in the tropics, and now grown somewhat in S. Fla. and S. Calif. for the fleshy calyxes, which, when cooked, make an excellent sauce or jelly with the flavor of cranberry. The green seed pod is not edible. The juice from the calyxes makes a cooling acid drink. Thrives in hot, dry climates.

4. **esculéntus**, Linn. (*Abelmóschus esculéntus*, Moench). OKRA. GUMBO. Mostly strict, 2–6 ft., the stems terete and more or less hispid: lvs. cordate in outline, 3–5-lobed or divided, the lobes ovate-pointed and coarsely toothed or notched: fls. solitary and axillary, on inch-long peduncles, yellow, with a red center: fr. a long ribbed pod (5–12 in. long), used in cookery. Trop. Asia.—For culture, etc., see *Okra*. A large-fld. form (var. *speciosus*, cf. *H. Manihot*) in Gt. 43, p. 623.

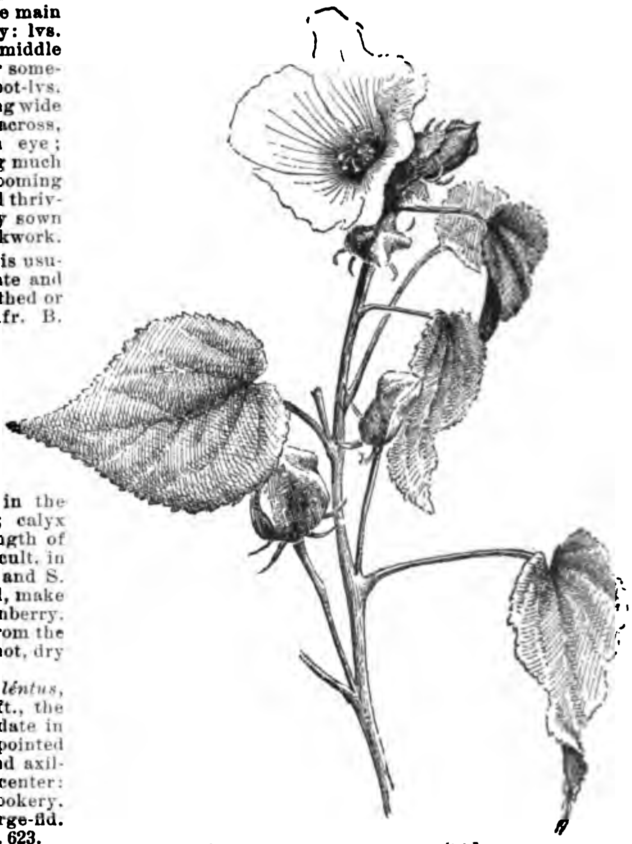
AA. *Perennial herbs, mostly grown as border plants.*

These plants are late summer and fall bloomers, with hollyhock-like fls. They send up new, strong shoots or canes each year. Many of them are perfectly hardy in the N., but even these profit by a mulch covering. Others are tender in the N., and the roots should be taken up after frost and stored in a dry, warm cellar. Keep them just moist enough to maintain life in them. Many times the roots of these herbaceous species are set in large pots in the spring, and they then make most excellent specimens. All the species require a deep, rich soil and plenty of water.

B. *Foliage green and usually glabrous.*

5. **Mánihot**, Linn. Tall and stout (3–9 ft.), glabrous or hairy: lvs. large, palmately or pedately 5–9 parted into long and narrow oblong-lanceolate dentate lobes: involucre bracts oblong-lanceolate, falling after a time (as does the calyx): fls. large (4–9 in. across), pale yellow (sometimes white), with a purple eye: capsule oblong and hispid. Old World tropics, and spontaneous in S. states. B.M. 1702; 3152 (lvs. more cut). S.H. 2:263.—This is apparently the Sunset Hibiscus of the trade; also the Queen of the Summer Hibiscus. In botanical works, *H. Manihot* is said to be an annual, but as known to horticulturists it is a perennial. For a discussion of this point as related to the limitations of the species, see G. C. III. 22:249; Gn. 53, p. 127 (and plate 1157). Botanically, the species is allied to *H. esculéntus*. Not hardy in the open in the North, but the roots may be taken up in the fall and carried over winter in a warm, dry cellar. In the middle states and South, it may be expected to survive if well mulched. Grows readily from seeds, blooming late the first year if the seeds are started under glass.

6. **aculeàtus**, Walt. Not very stout, 2–6 ft. tall, hispid all over but not tomentose nor whitish: lvs. roundish or roundish-ovate in outline, 3–5-lobed or -parted, the sinuses often rounded and enlarging, the lobes angled or toothed and blunt: fls. 3–4 in. across, yellow, with purple in the base. S. Car. south.—Not hardy North.


1055. Hibiscus Moscheutos (× ¼).

7. **coccíneus**, Walt. (*H. speciòsus*, Ait.). Green and glabrous throughout, 3–4 ft.: lvs. palmately lobed, or the lowest and sometimes all of them palmately compound, the divisions long-linear-lanceolate and remotely toothed: fls. very large (5–6 in. across), rose-red, the petals obovate and conspicuously narrowed at the base; column of stamens very long. Ga. south. B.M. 360. R.H. 1858, p. 575; 1866:230.—Not hardy North. Take up roots and store in cellar.

8. **militàris**, Cav. Four to 6 ft., strong-growing, glabrous: lvs. rather small, usually hastate (2 short lobes at base), the middle lobe ovate-lanceolate or triangular-lanceolate, long-acuminate, equally crenate-toothed: involucre scales linear or awl-like, nearly or quite half as long as the calyx: fls. 3–5 in. across, white, blush or pale rose, purple-eyed. Wet places, Pa. to Minn. and south to the Gulf. B.M. 2385.—A hardy and fine species. Forms occur with lvs. not lobed.

BB. *Foliage soft-white-tomentose beneath and sometimes on top.*

C. *Lvs. not lobed (or only slightly so).*

9. **Moscheùtos**, Linn. (*H. palústris*, Linn.). Fig. 1055. Strong-growing, 3–5 ft., the terete stem pubescent or tomentose: lvs. mostly ovate, entire in general outline or sometimes shallowly 3-lobed at the top, blunt or crenate-toothed, very soft-tomentose beneath but becoming

nearly or quite glabrous above, the long petiole often joined to the peduncle: involucre bracts linear, nearly or quite as long as the tomentose calyx: fls. very large (4–7–8 in. broad), light rose-color (or white in var. *albus*), with a purple eye: capsule glabrous. Marshes along the coast from Mass. to Fla. and west to L. Michigan. B.M. 882. B.R. 17:1463; 33:7. Mn. 2:161. Gng. 2:227. *H. ròseus*, Thore, of Europe, a rose-colored form, is considered to be a naturalized form of this American species. R.H. 1879:10.—One of the best of the Marsh Mallows, thriving in any good garden soil. Of easiest culture and perfectly hardy. Blooms in Aug. and Sept. The foliage is strong and effective. The most generally cultivated of the hardy herbaceous kinds. The form known as Crimson Eye (clear white with a crimson center) was introduced 1894 by Wm. F Bassett & Son. It was found in a swamp in New Jersey. There is some question, however, as to whether it is specifically the same as *H. Moscheutos*. The fls. are pure white (except the center), expand wide, and the lvs. are bronze-tinted. The carpels are more attenuate.

10. **incànus**, Wendl. Much like *H. Moscheutos*, and sometimes passing for it in the trade: lvs. smaller and narrower, ovate-lanceolate, not lobed, serrate-toothed: fls. sulfur-yellow, with a crimson eye. S. Car. and south. —Seems to be hardy in the North with a mulch protection.

11. **Califórnicus**, Kell. Strong growing, 5 ft., the stem terete or slightly grooved above, more or less pubescent: lvs. distinctly cordate, ovate, shallow-toothed and not lobed, dull ashy gray beneath: involucre bracts hairy: corolla white or rose, with a purple eye, 3–5 in. across: capsule pubescent. Calif.—Gray regards this as a form of *H. lasiocarpus*, Cav. (var. *occidentàlis*, Gray). A portrait of *H. lasiocarpus* will be found in G.F. 1:426. Although the name *H. Californicus* is common in the trade, it is a question how much of the stock, if any, is this species. Certainly some of it is *H. Moscheutos*. From *H. Moscheutos* this species is told by its cordate ashy-tomentose lvs. and hairy-ciliate involucre bracts. The plant known to the trade as *H. Californicus* is hardy.

cc. *Lvs. strongly lobed.*

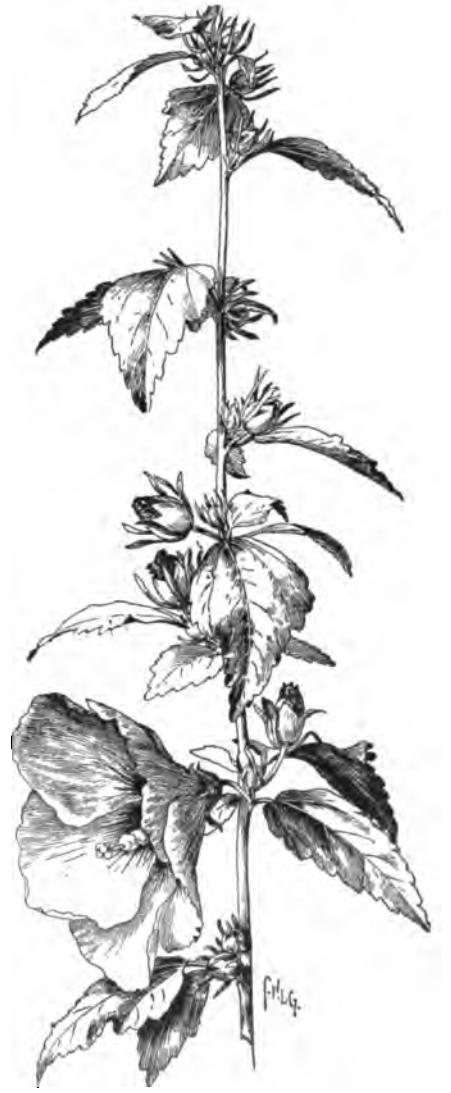
12. **grandiflòrus**, Michx. Tall and stout (3–8 ft.), the terete reddish stem becoming glabrous: lvs. large, 3-lobed, the lobes ovate-acuminate or ovate-oblong-acuminate, the side ones widely spreading, blunt-toothed or even again lobed: fls. very large (6–8 in. across), white or rose, with deeper eye. Ga., Fla. west.—Aside from the large fls. and lobed lvs., this is very like *H. Moscheutos*. It is doubtful if the true *H. grandiflorus* is in the trade.

AAA. *Shrubs, hardy in the North (or in the middle states).*

13. **Syriacus**, Linn. (*Althæa frùtex*, Hort.). SHRUBBY ALTHEA. ROSE OF SHARON. Figs. 1056, 1057. Shrub, 6–12 ft. high, much branched, nearly or quite glabrous: lvs. rather small, short-petioled, strongly 3-ribbed, triangular- or rhombic-ovate, mostly 3-lobed and with many rounded teeth or notches: fls. solitary in the axils on the young wood (late in the season), somewhat bell-shaped, 2–3 in. long, rose or purple, usually darker at the base: pod short, splitting into 5 valves. Asia. B.M. 83. R.H. 1845:133 (var. *speciosus*, with double fls.). —One of the commonest of ornamental shrubs, and hardy in Ontario. It is immensely variable in character of fls., the colors ranging from blue-purple to violet-red, flesh color and white; also full double forms. There are forms with variegated lvs. Colored plates of some of the double-fld. forms will be found in Gn. 52:1150. The species thrives in any good soil. Prop. by seeds, by cuttings of ripened wood taken in the fall, and named vars. by grafting on the common seedling stock. Nativity uncertain, but probably not Syrian, as Linnæus supposed: probably native in China. To this species belong such trade names as *H. purpùreus*, *H. speciòsus rùber*, *H. ranunculæflòrus*, *H. tòtus álbus*, *H. Lèopoldii*, *H. pæoniflòrus*, *H. cœléstis*, *H. violàceus*, *H. anemonæflòrus*, *H. atrórubens*, *H. bícolor*, *H. camellæflòrus*, *H. elegantíssimus*, etc.

1056. Capsule of Hibiscus Syriacus.

14. **Hamàbo**, Sieb. & Zucc. A Japanese species offered by importers but not yet tested in this country, and probably not hardy south of the southern-middle states: 6–10 ft. high, closely pubescent: lvs. roundish, with an abrupt short point, irregularly shallowly toothed, white tomentose: involucre of scales united at the base: fls. solitary in the upper axils, large, yellow, with a darker base.



1057. Hibiscus Syriacus (× ½).

AAAA. *Shrubs of glasshouses, or permanently planted out in the far South.*

B. *Lvs. hoary beneath.*

15. **elàtus**, Swartz (*Paritium elàtum*, G. Don). MOUNTAIN MAHOE. A West Indian tree, now introduced in S. Calif.: lvs. round-cordate, short-cuspidate, entire;

involucre deciduous (with the calyx), 8–10-toothed: fls. 4 in. long, opening primrose color in the morning, then changing, as the day advances, to orange and deep red. —This species, the next, and probably others, yield the Cuba bast, used for tying cigars and for other purposes. Lvs. and shoots medicinal: wood durable.

16. **tiliàceus**, Linn. (*Paritium tiliàceum*, Juss.). Round-headed tree 20–30 ft. high: lvs. round-cordate and short-acuminate, entire or obscurely crenate: involucre persistent (with the calyx), 10-toothed: fls. 2–3 in. long, yellow. Old World tropics, but naturalized in the W. Indies and at Key West.—Offered recently by Reasoner. Evergreen. Sprouts from the base if frozen.

BB. *Lvs. usually green both sides.*

17 **heterophýllus**, Vent. Tall shrub of Australia, int. in S. Calif., where it is a free and showy bloomer: nearly glabrous: lvs. varying from linear to lanceolate and elliptic-oblong and from entire to 3-lobed, 5–6 in. long, usually serrulate and sometimes white beneath: fls. large (3–4 in. long), white, with a deep crimson eye, the calyx tomentose: capsule hairy.

18. **calycinus**, Willd. (*H. chrysánthus*, Hort.). Small shrub from S. Africa, and sparingly known in this country: pubescent: lvs. long-stalked, round-cordate, somewhat 3–5-angled and 5–7-nerved, crenate, hairy or velvety: fls. on axillary peduncles which are shorter than the petioles, large, yellow, with a dark center: involucre bracts 5, bristle-pointed: capsule tomentose. —To be grown indoors, but may be planted out in the summer with good results. Probably valuable for permanent planting in the extreme S.

19. **cisplátinus**, St. Hil. Bushy, 3–5 ft.: stems glabrous but prickly: lvs. deltoid-lanceolate or deltoid-ovate, 3-lobed, coarsely toothed, sparsely hairy on the veins: fls. solitary, 4–5 in. across, light pink, with darker color in the eye and sometimes darker on the margins. Brazil (this side the Platte river, whence the specific name). R.H. 1898:480. Gng. 7:50.—Little known in this country. It is a late fall bloomer, and may be planted out in summer. It seeds freely, and these, sown as soon as ripe, will give blooming plants for the following fall. Handsome.

20. **Dénisoni**, Burb. Small glasshouse shrub, flowering when very small, glabrous: lvs. thick and rather stiff, slender-stalked, elliptic-ovate, entire or obscurely crenulate, acuminate, dull green: fls. terminal, large, white, 4–5 in. across. Nativity unknown, but int. from Austral. F.M. 1876:232.—A good greenhouse plant, requiring warm temperature.

1058. Hibiscus Rosa-Sinensis (× 1-5).

21. **Ròsa-Sinénsis**, Linn. (*H. Sinénsis*, Hort.). CHINESE HIBISCUS. SHOEBLACK PLANT. Fig. 1058. In glasshouses a shrub 3–8 ft. high, but reaching 20 ft. in subtropical regions, glabrous: lvs. rather large, thin and shining green, broad-ovate to lance-ovate, somewhat tapering to the base, acuminate, coarsely and unequally toothed: involucre bracts linear, free, as long as the calyx tube: fls. solitary in the upper axils of the new growth, on peduncles which exceed the petioles, bright rose-red, 4–5 in. across, with a projecting red column of stamens and pistil. Asia, probably China: now distributed in warm countries, and one of the best known old-fashioned conservatory pot-plants. B.M. 158. I.H. 29:441. G.C. III. 2:529. Gn. 53, p. 127.—It is now immensely variable. Forms are double-fld., and others are orange, yellow, bright red, magenta, and parti-colored. Var. **Coòperi**, Hort. (*H. Coòperi*, Hort.), has narrow white-marked lvs. and distorted scarlet fls. Trade names belonging to this species are *H. brilliantíssimus*, *H. carminàtus*, *H. chrysánthus*, *H. fúlgidus*, *H. fúlgens*, *H. kermesìnus*, *H. lùteus*, *H. miniàtus*, *H. sub-violàceus*, *H. zebrìnus*. *Hibiscus Rosa-Sinensis* is a summer-flowering shrub which always attracts attention. It is often plunged in the open with other subtropical stuff. It is easy to grow in ordinary potting soil. In winter keep it slow by witholding water and keeping in a temperature not above 50°. In spring head the plants in and start them up to get the new wood on which the flowers are borne. Give plenty of water when growing, and syringe frequently. Prop. readily by softwood cuttings in spring, or by hard cuttings in fall.

H. Archeri, Hort., is a hybrid of H. Rosa-Sinensis and H. schizopetalus, raised by A. S. Archer, Antigua, West Indies. Much like H. Rosa-Sinensis. Fls. red. Gn. 55:1221.—*H. Cámeroni*, Knowles & Weste. Tall shrub, with heart-shaped 3-lobed lvs. and large, solitary, cream-colored, red-veined fls. Madag. B.M. 3936. The plant figured under this name in Gn. 53:1164 is probably a form of H. Rosa-Sinensis.—*H. mutábilis*, Linn. Tree-like or tall shrub: lvs. cordate, 5-angled, toothed, downy: fls. axillary, opening white or pink but changing to deep red by night: involucre bracts shorter than calyx. China. Cult. in tropical and subtropical regions. Recently introd. in S. Fla. under the name of Cotton Rose and Confederate Rose.—*H. schizopétalus*, Hook. f. Allied to H. Rosa-Sinensis: fls. pendulous, the recurving petals beautifully cut, the involucre none, the fruit long and bearing glabrous seeds. E. tropical Afr. B. M. 6524. F.S. 23:2397–8. One of the handsomest of the genus. —*H. spléndens*, Fras. Shrub, 12–20 ft., soft-tomentose, prickly: lvs. cordate-ovate, palmately 3–5–7-lobed: fls. very large, rose-red. Austral. B.M. 3025. B.R. 19:1629. Handsome.—*H. Suratténsis*, Linn. Trailing, with palmately 3–5-parted lvs.: fls. yellow: involucre bracts with odd nail-like spines. India, but widely distributed. G.C. III. 9:529.—*H. venùstus*, Blume. Very like H. mutabilis, but involucre bracts broad. Java. B. M. 7183.—*H. villòsus*, undetermined trade name.

L. H. B.

HICKORY-NUT. Notwithstanding the high esteem in which the nuts of several species of Hickory have been held since the settlement of America by the white men, but little progress has been made in their domestication and improvement. Out of the 9 or 10 species recognized by botanists, not more than 3 or 4 have been found sufficiently promising from an economic standpoint to justify conspicuous effort at amelioration. Of these the Pecan (*H. Pecan*) stands easily first, followed in order of apparent value by the Shagbark (Little Shellbark), *H. ovata*; the Shellbark (Big Shellbark), *H. laciniosa*, and the Pignut, *H. glabra*. The Pecan differs in its requirements of soil and climate from the other species, and is described separately under *Pecan*. For the botany of the Hickories, see *Hicoria*.

In flavor and quality of kernel the Shagbark is esteemed by most Americans as the choicest of native nuts, though in these respects the Shellbark is but little inferior to it. The thinner shell and larger proportion of kernel have given the former precedence over the latter in most cultural efforts; though the thrifty growth, symmetrical form and luxuriant foliage of the latter render it one of the most handsome and useful of native trees for roadside or lawn planting. The Shagbark has the broader area of natural distribution, being found in localities throughout most of the United States to the eastward of the Great Plains, except on the lowlands of the South Atlantic coast and Gulf states. The Shellbark is mainly confined to the valley of the Mississippi and its larger tributaries, extending eastward, however, into eastern Pennsylvania and western New York.

The Pignut, which is similar to the Shagbark in area of distribution, is much inferior to the others in quality, but shows wider variation than either in this respect, and has disclosed at least one variety of distinct cultural merit.

As the Hickories, other than the Pecan, are slow-growing species at best, they should not be planted on other than fertile soil. The Shellbark is native to river bottoms, and requires richer land than the others, which endure a rather wide range of soil characteristics, provided there is sufficient depth and good drainage. Deep, well-drained, fertile loams, either of sandy or clayey nature, are acceptable to all the species.

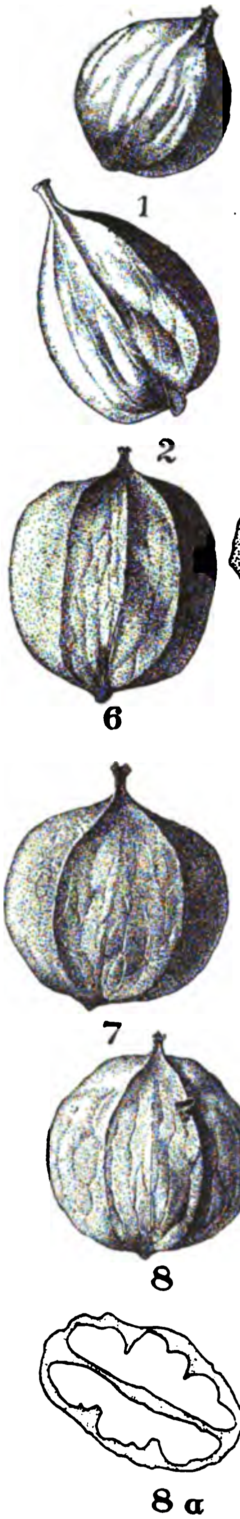
Propagation.—All the species are propagated by seed. Planting is frequently done in autumn, but, to lessen the destruction by rodents, is more safely done in early spring. In such case the freshly gathered nuts, after removal from the hulls, should be stored in slightly dampened sand during the winter, or stratified, as other tree seeds. Uniformity of growth is promoted by planting nuts where trees are to stand, as the transplanting process in ordinary seasons is accompanied by a considerable loss. If trees must be transplanted, it is probably best to transplant annually in nursery rows, in rich soil, to promote growth of fibrous roots and to lessen the shock of final transplantation to the permanent location.

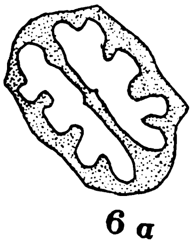
The propagation of the Hickories by budding and grafting is exceedingly difficult, even the most experienced propagators of woody plants failing to secure more than a small percentage of success. Most growers favor cleft crown-grafting in the spring, on established stocks of the same species. The operation is performed just as stocks are starting into growth, using dormant cions with terminal buds and mounding up to the top bud with fine earth. As the stocks are in condition only for a few days, the process is uncertain and expensive.

One of the most successful propagators of woody plants, Jackson Dawson, of Arnold Arboretum, recommends the use of the Bitternut (*H. minima*) as a stock, growing seedlings in boxes 4 in. deep for one or two years, until of sufficient size for grafting. Under this plan the seedlings should be transferred to pots in the autumn and taken into the greenhouse about January 1. He advises side-grafting these close to the collar. As soon as the roots begin to start, the grafted trees in pots must be plunged in sphagnum to the top bud and left until March to callus. Root-grafting, as commonly practiced, has rarely been found to succeed.

One promising method of root-propagation suggested by Fuller consists in the "turning up or exposing at the surface of the ground of side roots, severed from the parent tree." Their lower extremities are left in place for one or two seasons, until a distinct top has been formed through the agency of adventitious buds on the exposed portions. Though a slow and expensive process, this is probably more certain than any other method yet developed. In some instances, where the tops of trees have been killed, the varieties have been perpetuated through this practice by promptly turning up and staking roots that were yet alive.

Planting should be done in autumn, or as early in spring as the ground can safely be worked. An abundance of rich soil should be used in the holes, as much of the success in transplanting depends upon a prompt and vigorous root-growth. If clean cultivation cannot be practiced, a heavy mulch should be applied, and be maintained for several years, until the tree is well established. After this, little care is needed, except to guard against the attacks of leaf-eating insects.





1059. Forms of Hicoria ovata.
1. Ovate form. 2. Long-ovate form. 6, 6*a*. Meriden. 7. Jackson. 8, 8*a*. Milford. Nat. size.

Production and Use.—Large quantities of Shagbarks are consumed in our cities, but the supply is mainly from the forests.

In some sections, choice second-growth trees have been preserved along fences and roadsides, and these are usually found to yield larger crops and finer nuts than the forest trees. In portions of southeastern Pennsylvania there is a large production of nuts from such trees. In that section the nuts are marketed in the form of kernels free from shells, for use by confectioners and bakers. The cracking of the nuts is done by women and children on the farms, this work constituting a domestic industry of some importance at certain seasons. As the use of Shagbarks in cooking is apparently increasing, it is important that trees bearing choice nuts shall be preserved and cared for. The characteristics that determine commercial value are: first, cracking quality; second, thinness of shell; third, size; fourth, plumpness and flavor of kernel; fifth, productiveness.

Numerous apparently natural Hickory hybrids have been brought to notice, but those thus far discovered have given little evidence of cultural value. The most important are the Nussbaumer and McCallister nuts, which are described under *Pecan*.

Varieties.—In consequence of the difficulty with which the Hickories are propagated by budding and grafting, few nurseries offer other than seedling trees. Several choice varieties of Shagbark have been described and named because of desirable characteristics, however, and several of these have been propagated in a small way by crown-grafting on established trees. Grafted trees of one variety, the Hales, can be obtained in small numbers at one or two nurseries. No varieties of the Shellbark have been offered by nurserymen. The illustrations (Fig. 1059) are adapted from the Nut-Culture Bulletin of the U. S. Dept. of Agric.

The more important varieties are the following:

SHAGBARK: *Curtis.*—Conn. A smooth nut of medium size, slightly compressed: kernel plump, light in color and of good quality: shell thin; cracking quality good.

Dover.—Pa. A medium-sized angular nut, rather broad at the base, but having a long and sharp basal point: shell moderately thin; cracking quality good: quality good.

Eliot.—Conn. Of medium size, compressed, angular, ovate, with prominent tip: kernel plump; flavor mild and pleasant: shell thin; cracking quality good.

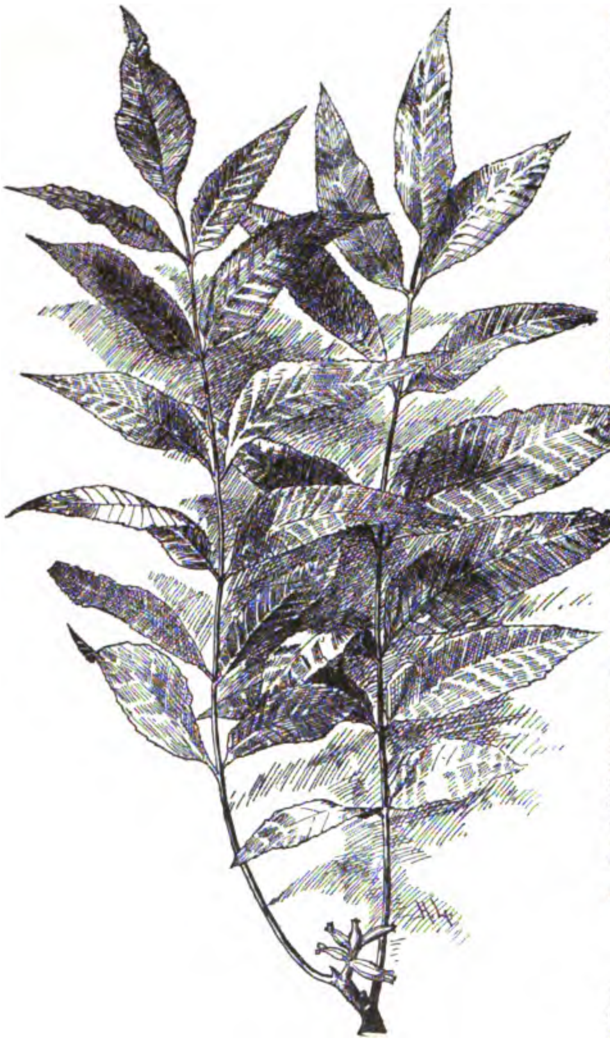
Hales (*Hale's Papershell*).—N. J. Large, quadrangular, slightly compressed, with a peculiar wavy surface: kernel rather deeply corrugated, but plump and of good quality, retaining its sweetness for two years or more: shell thin and of fair cracking quality. The Hales nut is the first named variety of Hickory, having been described and illustrated by A. S. Fuller in "The Rural New-Yorker" in 1870. It is probably the only sort now obtainable at the nurseries. The original tree bears a fair crop annually, and numerous younger trees grafted from it are now in bearing.

Jackson.—Ohio. A compressed oval nut of large size: kernel large, plump, and of excellent quality: shell thin; cracking quality medium. Fig. 1059.

Leaming.—Mo. A large nut of fine flavor and excellent cracking quality, the kernel coming out in unbroken halves.

Meriden.—Conn. Large, oblong, compressed: kernel large and of good quality: shell rather thick, but cracks well. Fig. 1059.

Milford.—Mass. A compressed ovate nut, medium to large in size, with large, plump kernel of excellent quality: cracks well: one of the best nuts yet brought to notice. Fig. 1059.



1060. Foliage and pistillate flowers of Hicoria Pecan.

Rice.—Ohio. Angular, ovate, medium to large in size: kernel plump, bright and of fine quality: shell thin and of good cracking quality: tree regularly productive.

Woodbourne.—Pa. Long, compressed ovate, large and smooth: kernel tender and of very high quality: shell rather thick, but cracks well.

PIGNUT: Of the somewhat numerous sweet-flavored forms found in this species, the following one at least has been deemed worthy of perpetuation because of its delicate flavor, thin shell and excellent cracking quality.

Brackett.—Iowa. Roundish compressed, smooth and of grayish color, medium to large in size: kernel plump, sweet and of delicate flavor: shell very thin, and easily freed from the kernel.

WM. A. TAYLOR.

HICÒRIA (from its aboriginal name) Syn., *Càrya. Juglandàceæ.* HICKORY. Hardy ornamental trees, with rather large, deciduous odd-pinnate lvs., small greenish fls., the staminate ones in conspicuous pendulous racemes, and with rather large, green, dehiscent fruits enclosing a mostly edible nut. The Hickories are among the most beautiful and most useful trees of the American forest, and are all very ornamental park trees, with a straight, sometimes high and slender trunk and a large, graceful, pyramidal or oblong head of generally light green foliage, turning from yellow to orange or orange-brown in fall. They are hardy North except *H. Pecan*, *aquatica* and *myristicæformis*, but *H. Pecan* thrives rarely in Massachusetts in sheltered positions. Most of the species have heavy, hard, strong and tough wood, much valued for many purposes, especially for handles of tools, manufacture of carriages and wagons, also for making baskets and for fuel. The nuts of some species, as *H. Pecan* and *H. ovata*, also *H. laciniata* and some varieties of *H. glabra* and *H. alba* are edible, and are sold in large quantities, mostly gathered from the woods, though in later years orchards of improved varieties have been planted. A large number of insects prey upon the Hickory, attacking the wood, foliage and fr., for which see the Fifth Ann. Rep. of the U. S. Entom. Com., p. 285–329. There are also some fungi, causing sometimes an early defoliation of the trees.

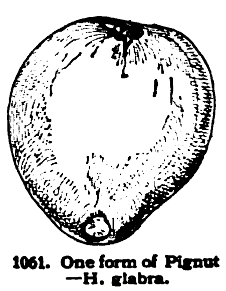
The Hickories generally grow best in rich, moist soil, but some, especially *H. glabra*, *H. alba* and *H. ovata*, grow equally well in drier localities. They are of rather slow growth, and difficult to transplant if taken from the woods; therefore the seeds are often planted where the trees are to stand, but if grown in the nursery and transplanted several times when young, trees 6–10 ft. high may be transplanted successfully. Prop. usually by seeds stratified and sown in spring in rows about 3 in. deep; named varieties may be grafted in spring in the greenhouse, on potted stock of *H. minima*, which seems to be the best species for this purpose, veneer- or splice-grafting being usually employed; sometimes also increased by root-sprouts. For futher horticultural advice, see *Hickory-nut* and *Pecan.*

There are about 10 species of Hickory, all in E. N. America from Canada to Mexico. Branches with solid pith: lvs. alternate, without stipules, with 3–17 serrate lfts.: fls. monœcious, apetalous, appearing with the lvs.; staminate fls. in axillary, slender, pendulous catkins, each fl. with 3–10 stamens, borne in the axil of a 3-lobed bract; pistillate fls. in a terminal, 2–10-fld. cluster or spike, consisting of a 1-celled ovary enclosed by a 4-lobed involucre: fr. globular to oblong, with a husk separating into 4 valves and a bony nut, incompletely 2–4-celled. See also Rep. Missouri Bot. Gard. 7, p. 28–42, pl. 1–23, and Rep, of U. S. Dept. of Agric. Div. of Pomol. Nut-Culture (1896), cited below as U.S.N.C. (the first number referring to the plate, the second and third to the figure).

A. *Scales of buds valvate, 4–6: fr. with winged sutures; nut usually thin-shelled: lfts. 7–13, usually falcate.*

B. *Nut mostly elongated, almost terete: husk thin, splitting to the base: kernel sweet.*

Pecán, Britt. (*Càrya olivæfórmis*, Nutt.). PECAN. Fig. 1060. Tall tree, to 170 ft., with the branches pubescent when young: bark deeply furrowed, grayish brown: lfts. 11–17, short-stalked, oblong-lanceolate, acuminate, serrate or doubly serrate, tomentose and glandular when young, usually glabrous at length, 4–7 in. long: staminate catkins almost sessile: fr. 3–10 in clusters or spikes, oblong, 1½–3½ in. long; nut ovoid or oblong, smooth, brown, irregularly marked with dark brown, 2-celled at the base; kernel sweet. From Iowa and Ind. south to Alab. and Tex.; also in Mexico. S.S. 7: 338–39. A. G. 12:273–75. U. S. N.C. 1, 8, 9.—This species is the most important as a fruit tree, and many named varieties are cultivated in the southern states, but it is tender North. The wood is less valuable than that of the other species. Hybrids of this species are known with *H. minima*, *alba*



1061. One form of Pignut —H. glabra. Natural size.

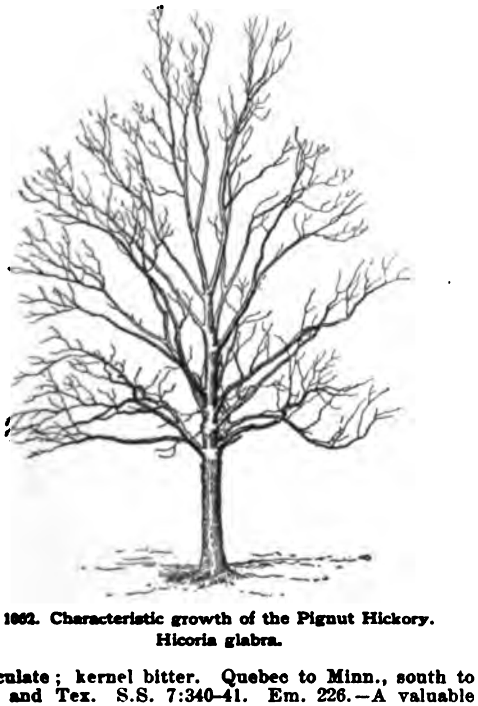
and *laciniosa*, for which see Rep. Mo. Bot. Gard. 7, pl. 20–23 and Gng. 2:226. See *Pecan*.

myristicæfórmis, Britt. (*Carya myristicæfórmis*, Nutt.). NUTMEG-HICKORY. Tree, to 100 ft. with dark brown bark, broken into appressed scales: lfts. 5–11, short-stalked or almost sessile, ovate-lanceolate, the uppermost much larger and obovate, serrate, scurfy-pubescent beneath when young and with brown scales above, at length dark green above, silvery and lustrous beneath, 3–5 in. long: staminate catkins peduncled: fr. generally solitary, short-ovoid or obovate, about 1½ in. long; nut ovoid, reddish brown marked with irregular spots and stripes, thick-shelled, 4-celled below; kernel sweet. From S. Car. to Ark. and Mex. S.S. 7:342–43.—A very decorative species on account of its handsome foliage, but not hardy North.

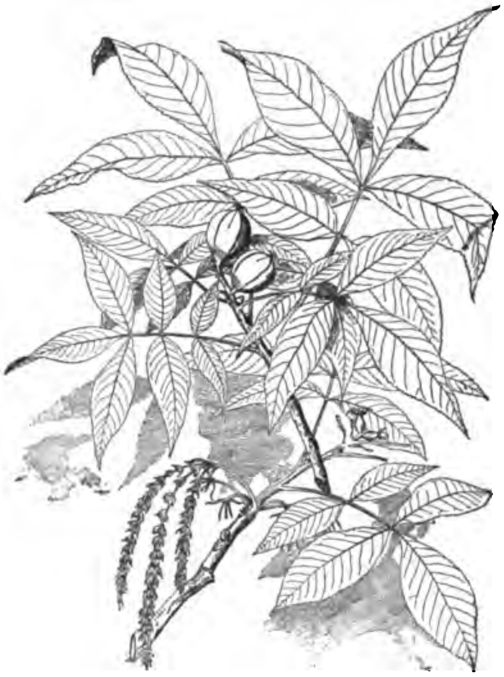
BB. *Nut usually as broad as long, compressed with irregularly angled or reticulate surface, thin-shelled, 4-celled below: kernel bitter.*

aquática, Britt. (*Carya aquática*, Nutt.). WATER-HICKORY. BITTER PECAN. Usually small tree, rarely to 100 ft., with light brown bark separating into long, thin plates: lfts 7–13, sessile or short-stalked, lanceolate, long-acuminate, finely serrate, yellowish tomentose when young, glabrous at length. fr. 3–4, ovoid to broadly obovate, 1–1½ in. long; husk thin, splitting to the base; nut obovate, much compressed, irregularly angled and ridged, dull reddish brown; kernel very bitter. From Va. to Ill., south to Fla. and Tex. S.S. 7:344–45. U.S.N.C. 12, 7–8.

mínima, Britt. (*Carya amára*, Nutt.). BITTER NUT. SWAMP-HICKORY. Tree, to 100 ft.: bark grayish brown, broken into thin scales: young branches and petioles glabrous: lfts. 5–9, ovate-lanceolate to lanceolate-acuminate, densely serrate, pubescent when young and glandular, almost glabrous at length, 3–6 in. long: fr. 2–3, broadly obovate or subglobose, winged from the apex to the middle, ¾–1½ in. long; husk thin, splitting somewhat below the middle; nut slightly compressed, roundish, abruptly contracted into a short point, irregularly reticulate; kernel bitter. Quebec to Minn., south to Fla. and Tex. S.S. 7:340–41. Em. 226.—A valuable park tree, with handsome, rather broad head, growing in cult. more rapidly than other Hickories.



1062. Characteristic growth of the Pignut Hickory. Hicoria glabra.



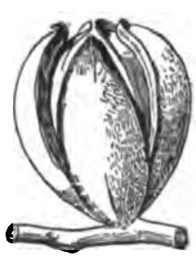
1063. Hicoria glabra, var. microcarpa—the false Shagbark.

AA. *Scales of buds imbricate, more than 6: fr. not or slightly winged at the sutures: nut usually thick-shelled, 4-celled below: lfts. 3–9, not falcate, the uppermost larger and generally obovate.*

B. *Buds small, ¼–½ in. long: husk thin: nut slightly or not angled.*

glàbra, Britt. (*Carya porcìna*, Nutt.). PIGNUT. Figs. 1061, 1062. Tree, occasionally to 120 ft., with usually dark gray fissured bark and slender, glabrous branchlets: lfts. 3–7, almost sessile, oblong to oblong-lanceolate, long-acuminate, sharply serrate, almost glabrous, 3–6 in. long: fr. usually ovoid or obovate, the sutures usually slightly winged toward the apex and the husk splitting mostly only half way to the base; nut usually brownish, not angled; kernel mostly astringent. S.S. 7:352–53. A.G. 11:386–7. U.S.N.C. 12, 5.—A very handsome park tree, with rather narrow-oblong head and slender, often pendulous branchlets, especially in the following var. A very variable tree, and the following varieties are considered by some botanists as distinct species.

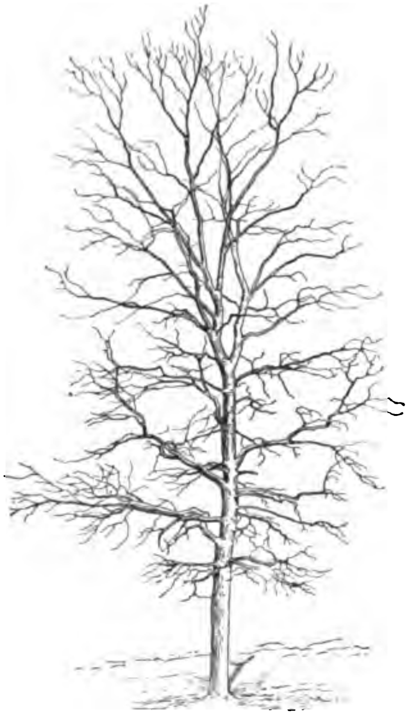
Var. **microcárpa**, Trel. (*Carya microcárpa*, Nutt.). Figs. 1063–6. Bark more or less shaggy: lfts. quite glabrous, often somewhat broader: fr. subglobose; husk splitting nearly to the base; nut grayish or whitish, angled, rather thin-shelled, often broader than long; kernel sweet. From Quebec to Mich., south to Fla. A.G. 11:381–88, 1, 2, 5, 8, 10. U.S.N.C. 12, 4, 6.—Often very distinct. Probably *H. borealis*, Ashe, belongs to this variety. Var. **odoràta**, Sarg. Similar to and often united with the former. Bark fissured,



1064. Fruit of H. glabra. var. microcarpa, the false Shagbark. Natural size.

1065. Twig of Hicoria glabra, var. microcarpa.

not shaggy: lfts. generally broader, ovate or oblong-ovate, glandular: fr. more ovoid, splitting almost to the base; nut gray or brownish, slightly angled. S. S. 7:354 (partly). Var. **villòsa,** Sarg. (*H. pállida*, Ashe). Bark deeply fissured: lfts. 5–7, hairy along the midrib beneath and the rachis covered with tufts of hair: fr. subglobose to ovoid; nut brown, thick-shelled. Mo. to Del. and Ala. S.S. 7:355. G.F. 10:305



1066. Habit of the false Shagbark.
H. glabra, var. microcarpa.

BB. *Buds large, ½–1 in. long: nut angled; kernel sweet*

C. *Bark not shaggy: branches and petioles tomentose: outer bud-scales falling in autumn.: husk not separating quite to the base.*

álba, Britt. (*Carya tomentòsa*, Nutt. Not to be confounded with *C. alba*, which is *H. ovata*). MOCKERNUT. BIG BUD HICKORY. Tree, rarely attaining to 100 ft.: lfts. 7–9, almost sessile, oblong-lanceolate, long-acuminate, usually finely serrate, glandular and tomentose beneath, very fragrant when crushed, 4–8 in. long: fr. globose to pear-shaped, 1½–3 in. long; nut light brown, globular to oblong, slightly compressed, angled, narrowed toward the apex, thick-shelled; kernel small, sweet. Mass. to Ontario and Neb., south to Fla. and Tex. S.S. 7:350–51. U.S.N.C. 12, 1–3. Em. 222.

CC. *Bark shaggy, light gray: branches and petioles glabrous or pubescent: husk very thick, separating to the base: outer bud-scales persisting through the winter.*

laciniòsa, Sarg. (*Carya sulcàta*, Nutt. *H. acuminàta*, Dippel). BIG OR BOTTOM SHELLBARK-HICKORY. KING NUT. Tall tree, occasionally to 120 ft.: branchlets orange-red: lfts. 7–9, oblong-lanceolate, acuminate, serrate, pubescent when young, usually glabrous at length, 4–8 in. long: fr. generally oblong, 2–3 in. long; nut yellowish white, oblong, but sometimes as broad as long, slightly compressed and obscurely 4-angled, pointed at both ends; kernel sweet. N. Y. to Iowa, south to Tenn. and Ind. Terr. S.S. 7:348–49. U.S.N.C. 11.

ovàta, Britt. (*Carya álba*, Nutt.). SHAGBARK-HICKORY. Also LITTLE SHELLBARK-HICKORY, although the latter name by some is applied to the preceding. Figs. 1067, 1068. Tree, occasionally to 120 ft.: lfts. generally 5, sessile, oblong or oblong-lanceolate, acuminate, serrate, densely fimbriate, pubescent and glandular when young, glabrous at length, 4–6 in. long: fr. subglobose, about 1½–2½ in. long; nut white, oblong to broadly obovate, 4-angled; kernel sweet. From Quebec to Minn., south to Fla. and Tex. S.S. 7:346–47. Em. 217. U.S.N.C. 10. A. G. 11:386, 6, 9; 387, 3; 388, 11. Gng. 7:51. A.F. 14:339.—Next to Pecan the best as a fruit tree, especially for the northern states, where Pecan is not quite hardy. Several named varieties are in trade, of which probably var. *Halesi*, Hort., with large, thin-shelled nut, is the best known. An ornamental, often very picturesque tree; the stout branches forming a rather broad, usually somewhat open head.

H. Carolìnæ-septentrionàlis, Ashe. Allied to H. ovata: fr. smaller: lfts. 3–5, oblong-lanceolate, glabrous. N. C. to Ga.—*H. Mexicàna*, Engelm. Tree, with shaggy bark and tomentose-pubescent lvs.: fr. depressed, with rather thick husk and broad, sharply 4-angled, white nut. Mex. The only species not native to the U. S.—*H. Texàna*, Le Conte. Similar to H. Pecan, but lfts. broader, less falcate, almost sessile; nut smaller, much darker, with somewhat rough surface; kernel bitter. Texas.

ALFRED REHDER.

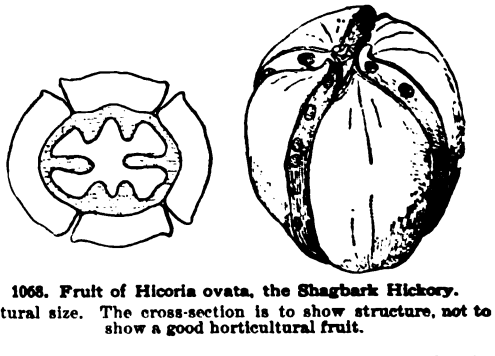
1067. Twig of Hicoria ovata.

HIDÁLGOA ("after the Mexican Hidalgo"). Syn., *Chìldsia*. *Compósitæ*. This includes a tender herbaceous vine, allied to Dahlia, with scarlet fls. about 2½ in. across, introduced in 1899 by John Lewis Childs, under the name of *Childsia Wercklei*, or "Treasure Vine." Hidalgoa is closely allied to Dahlia and Coreopsis, but differs from both in the large, fertile akene of the rays and in the sterile disc-fls., the styles of which are entire or very shortly 2-lobed. Only 2 species were hitherto recognized, both from Central America. From these *H. Wercklei* differs in its more compound lvs. and much larger heads. Suitable for cool, shady verandas.

Wércklei, Hook. (*Chìldsia Wércklei*, J. L. Childs). Tall, woody at base, much branched, climbing by petioles: lvs. opposite, pinnately ternatisect, 1½–2½ in. long, 2 in. wide, the teeth tipped reddish brown: petiole 1½–2 in. long, coiled at base: peduncle axillary, as long as the lvs., 1-fld.: rays about 10. Costa Rica. B.M. 7684. J.L. Childs' Cat. Rare Flowers, etc., 1899, p. 1, with colored plate. A.G. 20:570.

W. M.

HIERÀCIUM (Greek, *a hawk;* the ancients thought that hawks sharpened their eyesight by using the sap of these plants). *Compósitæ*. HAWKWEEDS. Over 250 species of hardy herbaceous perennials, mostly native to Eu. and S. Amer., some of which are bad weeds in the eastern states. Lvs. often toothed, but never deeply lobed: heads usually small, loosely paniculate or cymose, rarely solitary: rays truncate, 5-toothed at the apex: seeds angular. The genus passes into Crepis.



1068. Fruit of Hicoria ovata, the Shagbark Hickory.
Natural size. The cross-section is to show structure, not to show a good horticultural fruit.

from which it is distinguished by having stiff, usually brownish, rarely white pappus, and oblong or columnar seeds. The cultivated species bear in summer and autumn a succession of small yellow or orange-colored fls. There is one white-fld. species, *H. nivale*. They are often worth growing in rockeries and waste places, but care should be taken to prevent them from crowding out more desirable plants. *H. villosum* is the most desirable species. Hawkweeds will grow in almost any soil or aspect. They are propagated chiefly by dividing the stolons, or by seeds, and if left to themselves will soon form a dense mat of herbage over the poorest of soils. The Old World species are much confused.

A. *Flowering stem leafless or with 1–5 lvs.: lvs. mostly in a rosette at base of stem.*

B. *Scapes unbranched above, bearing but a single head.*

Pilosélla, Linn. MOUSE-EAR HAWKWEED. Stem slender, 4–12 in. high, stoloniferous, densely hairy throughout: lvs. entire, oblong or spatulate, narrowed into a petiole: fls. 1 in. broad, pale yellow, sometimes striped or tinged with red or purple.—Commonly flowers the whole season. Int. from Eu. and common in dooryards and fields. Ont. to Pa. and Mich.

BB. *Scapes branched above, bearing several to many heads.*

C. *Basal lvs. coarsely toothed.*

vulgàtum, Fries (*H. umbròsum*, Jord.). Stem 1–3 ft. high, slightly glaucous: basal lvs. 2–5 in. long, oblong to lanceolate, acute at both ends, petioled, petioles usually pubescent. July–Sept. Int. from Eu. Lab. to N. J.

CC. *Basal lvs. entire or very finely toothed.*

D. *Lvs. mostly obovate to ovate, purple-veined.*

venòsum, Linn. RATTLESNAKE WEED. Stem 1–3 ft. high, slender, smooth or nearly so: lvs. 1–4 in. long, obovate to spatulate, subsessile: fls. ½–¾ in. wide, bright yellow. Aug., Sept. Dry woods, Me. to Ga. and west to Man. and Neb. D. 133.—A common plant in woods. Advertised by one dealer in native plants.

DD. *Lvs. mostly spatulate to oblong, green-veined.*

aurantiacum, Linn. ORANGE HAWKWEED. Stem 6 in. to 2 ft. high, slender, somewhat hairy: heads ½–1 in. across, short-stalked, orange to orange-red. June–Oct. Nat. from Eu. by roadsides and in fields, Ont. to Pa.—A bad weed if allowed to spread. It is worthy of being established in high and dry parts of a rockery, where few other plants can grow.

præáltum, Vill. (*H. stoloniferum*, Bess.). Plants usually spreading very rapidly by stolons: stem 2–3 ft. high, slender, glaucous, hairy at base: basal lvs. entire: heads ½ in. across, in an open cyme, bright yellow. June–Sept. Nat. from Eu. along roadsides in N. Y.; sometimes troublesome in cult. land.

AA. *Flowering stem leafy, at least below.*

B. *Stem branching from the base.*

ramòsum, Waldst. & Kit. Lvs. ovate to lanceolate, narrowed at the base, toothed, hairy on margin and beneath; lower lvs. petioled, upper ones subsessile. July–Sept. Eu.

nivàle, Froel. WHITE HAWKWEED. Differs from *H. ramosum* chiefly in having white fls. and glaucous, somewhat leathery lvs., which are not hairy on the margin. A white Hawkweed is advertised and, according to Gray, this is the only white-fld. species in the genus. Tyrolese Alps.

BB. *Stem unbranched below.*

C. *Whole plant silky-villose.*

villòsum, Jacq. SHAGGY HAWKWEED. Stem 1–2 ft. high, often 4 ft. under cult.: basal lvs. oblong-lanceolate to lanceolate, narrowed at the base, finely toothed; stem-lvs. sessile, the upper half clasping: fls. 1½–2 in. across, bright golden. June–Aug. Eu. Gn. 46:994.—The silvery foliage and showy fls. of this species make it more desirable for the garden than any other Hieracium now in cultivation. It is easily kept from spreading.

CC. *Plant smooth or slightly pubescent.*

Canadénse, Michx. Stem 1–5 ft. high, slender: lvs. ovate-oblong to lanceolate, acute, serrate, sessile, the upper with clasping base: fls. 1 in. across. June–Aug. Dry woods, N. S. to Pa., west to B. C. and Ore.

Gronòvii, Linn. Stem 1–3 ft. high, stiff: lvs. hairy, the upper oval or oblong, broadly sessile, the lower obovate to spatulate, narrowed into a short petiole: fls. ½–¾ in. wide. Sandy soils, Can. to Fla., west to Mo. and La.

S. W. FLETCHER.

HIERÓCHLOË (Greek, *holy grass;* in northern Europe it is scattered before churches on saints' days). Also written *Hierochloa*. *Gramineæ*. This genus contains the fragrant Vanilla Grass, the sterile shoots of which are woven by the North American Indians into small mats, baskets and boxes. These retain their fragrance for years. It is a genus of 13 species of aromatic perennial grasses with creeping rootstocks, flat leaves and contracted or open panicles, found in temperate and frigid zones. The spikelets are 3-fld., only the terminal fl. perfect. Vanilla Grass is not a good forage plant, as most animals dislike it. The seed seems to be nowhere obtainable, and only one American dealer advertises plants of it. The odor is like that of the common annual sweet vernal grass, *Anthoxanthum odoratum*, but is more powerful. Hierochloë is closely allied to Anthoxanthum, but is distinguished by the 3-fld. spikelets and rather loose panicles, Anthoxanthum having 1-fld. spikelets and contracted panicles.

boreàlis, Roem. & Schult. (*H. odoràta*, Wahl.). VANILLA GRASS. HOLY GRASS. SENECA GRASS SWEET-SCENTED GRASS. Rather slender, smooth, 1–2 ft. high: lvs. short: panicle brownish, spreading, 2–4 in. long. June, July. Eu., N. Amer. B.B. 1:132.

G. T. HASTINGS.

HIGGÍNSIA. See *Hoffmannia*.

HIMANTOGLÓSSUM. All included in *Orchis*.

HIPPEÁSTRUM (*knight* or *horse* and *star*, from some fancied resemblance in *H. equestre*, perhaps of the equitant lvs. and the star-shaped corolla-opening). *Amaryllidàceæ*. Includes *Habranthus*. From 40 to 50 tropical American bulbous plants, now much hybridized. Closely allied genera are Amaryllis, Crinum, Sprekelia, Brunsvigia, Zephyranthes, Lycoris, Sternbergia, Vallota, which see. The fls. are large and showy, two to several being borne on a stout, hollow, leafless scape; perianth tube evident, often long, dilated in the throat; segments erect-spreading, nearly or quite equal; filaments (6) distinct, often with small scales between.

The Hippeastrums are usually known in gardens under the general name of Amaryllis; and their culture is given in full under that name. Many of them are noble garden plants, but the high price of the bulbs prevents them from becoming popular, although they may be grown easily from seeds. Most of the species were first described in the genus Amaryllis, but that genus differs in its solid scape and absence of scales between the filaments.

Very many of the names in trade catalogues are of horticultural forms; and many of them cannot be referred positively to any of the original species. For the Belladonna Lily, see *Amaryllis;* for Atamasco Lily, see *Zephyranthes;* for Josephine Lily, see *Brunsvigia*. For *Amaryllis aurea*, see *Lycoris;* for *A. candida*, see *Zephyranthes;* for *A. formossissima*, see *Sprekelia;* for *A. gigantea*, see *Brunsvigia;* for *A. longifolia*, see *Crinum;* for *A. lutea*, see *Sternbergia;* for *A. Nerine*, see *Nerine;* for *A. orientalis*, see *Brunsvigia;* for *A. ornata*, see *Crinum;* for *A. speciosa* or *purpurea*, see *Vallota*. Latin-form names which do not appear in the following account are very likely to be horticultural forms.

INDEX.

Ackermanni, 3.
acuminatum, 12.
Alberti 9.
aulicum, 2.
citrinum, 12.
crocatum, 12.
equestre, 6.
fulgidum, 6, 12.
ignescens, 6.
Johnsoni, 14.
Leopoldi, 10.
major, 6.
Maranensis, 8.
miniatum, 12.
pardinum, 5.
platypetala, 2.
procerum, 11.
psittacinum, 4.
pulcherrimum, 3.
pulverulentum, 12.
pyrrochroum, 6.
Reginæ, 9.
reticulatum, 7.
Rœzli, 6.
rutilum, 12.
solandriflorum, 1.
spathaceum, 6.
splendens, 6.
striatifolium, 7.
stylosum, 8.
subbarbatum, 12.
vittatum, 13.
Walteri, 6.

The genus divides itself into the narrow-leaved (lvs. linear) and broad-leaved sections. All the common garden sorts belong to the latter section. The species which are chiefly known in cult., or which have been parents of hybrid races, are contrasted below. In some species the flowers precede the leaves.

A. *Perianth tube 4–5 in. long, very slender.*

1. **solandriflòrum**, Herb. Bulb ovoid. 3–4 in. in diameter, with a short neck: lvs. appearing with the fls., 1–2 ft. long, 1–2 in. wide, blunt: scape somewhat flattened, 2–3 ft. tall, bearing 2–4 declined greenish white fls.: perianth tube cylindrical, nearly as long as the obovate sometimes purple-ribbed segments; stamens not exserted. S. Amer. B. M. 2573; 3771. L. B. C. 12:1200. I.H. 35:58.—Apparently little known in gardens, but is the parent of hybrids.

AA. *Perianth tube short (usually not more than 1 in. long).*

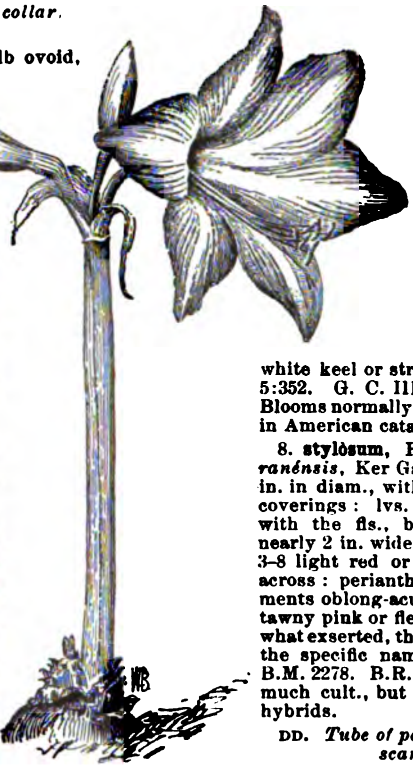
B. *Throat constricted or closed by a neck or collar.*

C. *Stigma 3-parted.*

2. **aùlicum**, Herb. LILY-OF-THE-PALACE. Bulb ovoid, 3–4 in. in diameter, with a short neck: lvs. 6–9, 1–2 ft. long, 2 in. broad, bright green, the end blunt or nearly so, appearing with the fls.: scape scarcely longer than the lvs., stout, terete, usually bearing 2 large red fls., of which the segments are green at the base: segments 5–6 in. long, the 2 upper inner ones much broader than the others, all of them obovate and somewhat pointed; corona in the throat green; stamens shorter than the perianth; filaments red. Brazil. B.M. 3311. B.R. 6:444. Gt. 45, p. 417.—One of the best, and common in the trade. The form known as var. **platypétala**, Lindl., B.R. 12:1038, with broader petals and more robust habit, is in the trade.

3. **Áckermanni**, Hort., is a garden hybrid, with large crimson fls. The var. **pulchérrimum**, Hort., with crimson, green-striped fls., is best known.

4. **psittacìnum**, Herb. Bulb 3–4 in. in diameter, with a long neck: lvs. with the fls., 6–8, lightly glaucous, becoming nearly or quite 2 ft. long: scape stout, 2–3 ft. tall, bearing a 2–4-fld. umbel: perianth segments 4–5 in. long, oblong and acute, undulate, the edge crimson, the main part green but crimson-striped; stamens much shorter than the perianth. S. Braz. B. R. 3:199. L. B. C. 13:1204.—Apparently little known in cult., but it has been a parent in hybridizations.



1069. Hippeastrum vittatum. (× ⅛.)

CC. *Stigma capitate.*

5. **pardinum**, Dombr. Bulb globular, 2–3 in. in diameter, with a short neck: lvs. 5–7, appearing with the fls. but not fully developed until after the fls. are gone, becoming 2 ft. long and 2 in. broad, narrowed to the base: scape nearly terete, 1½ ft. tall, glaucous, usually bearing 2 spotted fls.: perianth segments 4–5 in. long, oblong but much narrowed at the base, acute, greenish yellow and much spotted with red, not striped, the lowest inner segment narrowest; stamens declined, shorter than the perianth. Peru. B.M. 5645.—A handsome species, with fls. 6–7 in. across, offered in the American trade, and also a parent in the modern spotted hybrids.

BB. *Throat not constricted.*

C. *Stigma capitate or only obscurely lobed.*

D. *Tube of perianth ½–1 in. long.*

6. **equéstre**, Herb. BARBADOES LILY. Bulb globular, 2 in. in diameter, producing offsets freely, with brown scales and a short neck: lvs. 6–8, developing fully after the fls., 12–20 in. long and becoming about 2 in. wide, narrowed to the point: scape 1–2 ft., terete, glaucous: fls. 2–4, 4–5 in. across, the green tube 1 in. long, the segments obovate-pointed, bright red with green at the base, the 3 inner ones narrower than the outer; stamens shorter than the perianth. Mexico to Chile and Brazil. B. M. 305.—An old garden species, one of the best for winter and spring blooming. There are several garden forms and hybrids, with larger and better fls. Var. **spléndens**, Truff., R.H. 1895:578 (var. *Wálteri*, Wittm., Gt. 44. 1418), is larger in all its parts, fls. red, and the pedicels are longer. Var. **fúlgidum**, Hort. (not *H. fulgidum*. Herb.), has brilliant orange segments margined with white. Var. **ignéscens**, Hort., is deep clear scarlet, with white throat and white bars on the segments. Var. **màjor**, Hort., has very large, bright orange fls., with a green central star. B.R. 3:234. *H. Rœzli*, Regel, *H. pyrróchroum*, Lem., I. H. 11:420, and *H. spathàceum*, Sims. B.M. 2315, are regarded by Baker as forms of this species. There are double-fld. forms.

7. **reticulàtum**, Herb. Bulb nearly globular, with a short neck: lvs. appearing with the fls., rather short and broad for the genus, being oblanceolate, 1 ft. long and 2 in. broad, thin and bright green: scape about 1 ft. tall, nearly terete, bearing 3–6 tessellated or checkered fls. 4–5 in. across: fls. bright mauve or purple-red, with cross lines and bars of crimson, the segments obovate and much narrowed below; stamens shorter than the perianth, declined. S. Brazil. B. M. 657. Var. **striatifòlium**, Baker, has still broader lvs., with a white keel or stripe. B. M. 2113. B. R. 5:352. G. C. III. 4:477.—Handsome. Blooms normally in late summer. Offered in American catalogues.

8. **stylòsum**, Herb. (*Amarýllis Maranénsis*, Ker Gawl). Bulb globular, 3 in. in diam., with a short neck and pale coverings: lvs. 4–6, mostly appearing with the fls., bright green, becoming nearly 2 in. wide: scape 1–2 ft., bearing 3–8 light red or flesh-colored fls. 4 in. across: perianth tube ½ in. long; segments oblong-acute, less than 1 in. wide, tawny pink or flesh-red; stamens somewhat exserted, the style much so (whence the specific name). Guiana and Braz. B.M. 2278. B.R. 9:719.—Apparently not much cult., but it has been a parent of hybrids.

DD. *Tube of perianth very short (or scarcely any).*

9. **Reginæ**, Herb. Bulb globular, 3 in. in diam.: lvs. developing after the fls., 2 ft. long and 1½–2 in. broad, green: scape 10–20 in., bearing 2–4 red declined fls.: perianth segments 4–5 in. long, obovate and acute, the lowest innermost one narrower, all bright red, a large whitish star in the throat; tube sometimes nearly or quite 1 in. long; stamens shorter than the perianth. Mex. to Peru and Braz. B.M. 453.—An old garden plant, still much cult. There are double-fld forms: *Amarýllis Alberti*, Lem., I.H. 13:498, Baker considers to be one of these.

10. **Lèopoldi**, Dombr. Bulb globular, 2–3 in. in diam., with short neck: lvs. with the fls. or nearly so, often 2 ft. long: scape stout, 1½–2 ft., nearly terete, bearing about 2 large, very regular and parti-colored fls., measuring 6–7 in. across: perianth tube without any corona or constriction at the throat; segments obovate, 2 in. broad, the lower half dull crimson, the tips greenish white, the intermediate part bright red, with a forked white mark at the base of each, and a green-white throat. stamens declined, mostly exceeding the perianth, the filaments white; style exserted. Peru. G.C. 1870:733.—

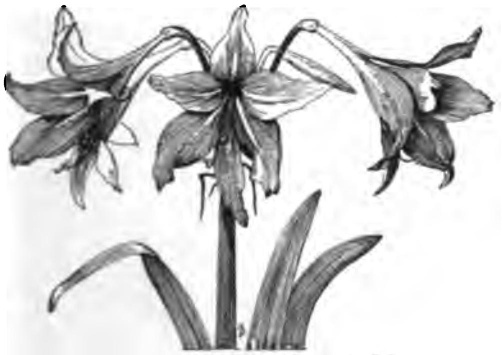
Distinct, and one of the best. Apparently not in the Amer. trade, but it has been used in hybridizing.

11. **prócerum**, Lem. (*Amarýllis Ràyneri*, Hook. f.). Bulb ovoid, with a neck 10–12 in. long, on the apex of which—as on a trunk—the drooping, curling, buff-edged lvs. are borne (the lvs. 16–20 in. long): scape 12–18 in. high, 2-edged, green, bearing 2–3 horizontal pale lilac fls. 4–5 in. across: segments oblanceolate, acute, not 1 in. broad; throat without a star; stamens much shorter than the perianth; stigma capitate. Brazil. I.H. 11:408. F.S. 20:2077–8. B.M. 5883. Gn. 45:959.—One of the most distinct of the genus. In the Amer. trade. Sometimes called "Blue Amaryllis" and "Empress of Brazil." Plant out for late summer or fall bloom, in a warm, sunny place. Keep bulb dry until late spring.

cc. *Stigma markedly 3-parted.*

12. **rùtilum**, Herb. Bulb nearly globular, 2–3 in. in diam., stoloniferous, with short neck: lvs. 6–8, elongating after flowering, bright green, 1 ft. long and an inch or more wide: scape as long as the lvs., somewhat compressed, glaucous, bearing 2–4 red fls.: perianth tube ¾ in. long, green, with a minute crown in the throat; segments oblong, acute, crimson and green keeled; stamens shorter than the perianth, the filaments red. Braz. B.R. 1:23. L.B.C. 15:1449.—In cultivation chiefly known in the var. **fúlgidum**, Baker (*H. fúlgidum*, Herb.), which is in all parts larger, deep crimson, the fl.-segments 3–5 in. long. B.R. 3:226. B.M. 1943, as *Amarýllis miniàta*; 2475 as *H. subbarbàtum*. Var. **crocàtum**, Baker, is as large as var. *fulgidum*, except in its fls., which are smaller, with undulate segments, saffron-colored. B. R. 1:38. Var. **citrinum**, Baker, has bright yellow fls. Var. **acuminàtum**, Roem. (*A.* and *H. pulverulénta*). Fls. pink and segments acute. B.R. 7:534; 14:1188. L.B.C. 5:484. B.M. 2273.

13. **vittàtum**, Herb. Fig. 1069. Bulb globular, 3 in. in diam.: lvs. 6–8, usually appearing after the fls., bright green, 2 ft. long: scape often 3 ft. high, bearing 3–6 horizontal or declined striped white-edged fls. 4–5-in. across: tube about 1 in. long, with an obscure crown or crest at the throat; segments obovate-oblong and acute, 1¼ in. or less broad, the under color whitish but overlaid with red stripes, the keel white; stamens shorter than the limb. Peru; but once thought to be S. African. B.M. 129. G.C. III. 24:119.—The commonest species-type in Amer. gardens, now cult. in many forms. It seems to have entered freely into hybrids, and some of the forms now passing as *H. vittatum* are perhaps mongrels. The double red feathery stripes on each side of the more or less irregular-edged segments distinguish this species from its congeners.



1070. Hippeastrum Johnsoni (× ¼).

14. **H. Jóhnsoni**, Bury. Fig. 1070. Fls. deep dull red, each segment with a white stripe down the keel. A very profuse bloomer, and withstands much abuse. It is the most popular single Amaryllid in this country, and is particularly prized for window-gardens. It is the oldest hybrid, having been raised by one Johnson, an English watchmaker, who, in 1799, crossed *H. Reginæ* with *H. vittatum*.

The three following Hippeastrums are offered in Dutch-American lists: *H. ádvenum*, Herb. Belongs to the narrow-lvd. section of the genus: lvs. linear, glaucous: fls. 2–6, about 2 in. long, yellow or red, on slender pedicels, the segments oblong-linear and acute; stigma 3-parted. Chile. B.M. 1125. B.R. 10:849. A form with pale yellow fls. is var. pallidus, Herb. L.B.C. 18:1760.—*H. praténse*, Baker. Also linear-lvd.: fls. 2–4, bright scarlet, the very short tube with small scales in the throat, the segments 2½ in. long; stigma capitate. Chile. B.R. 28:35.—*H. ròseum*, Baker. Lvs. narrow-linear, glaucous, 1 ft. long, with the fls.: scape 6 in. high, bearing 1 or 2 small bright red fls.: stigma 3-parted. Chile.

Latin-form trade names to be accounted for: *atrosanguíneum*, *cardinàlis*, *cròcea*, *delicàta*, *formòsa* (hybrid), *Gravinæ* (Craveana, Gravesiana, Graveana), *Lindeni*, *macrántha*, *refúlgens*, *rùbis* (hybrid), *rùbra stridta*, *Williamsii*. L. H. B.

HIPPÓPHAË (Greek, *horse-killing;* alluding to the berries, which are somewhat poisonous). *Elæagnàceæ*. This includes the Sea Buckthorn, a hardy European and mid-Asian shrub valued for its clusters of bright orange-red berries about the size of a pea, which persist all fall and winter. It also has the silvery or gray foliage which makes several members of this family useful in fine landscape effects. This family has only 2 other genera, Elæagnus and Shepherdia (including the Buffalo Berry). Hippophaë and Elæagnus have alternate lvs. and 4 stamens, but the former has unisexual and mostly diœcious fls., while the latter has hermaphrodite fls. Shepherdia has opposite lvs., 8 stamens and diœcious fls. Hippophaë has 2 species of shrubs or small trees: branches often spiny, covered with minute stellate hairs, as are all the young parts: fls. borne at the base of small lateral branches; staminate ones in catkins, sessile in the axils of 2 deciduous bracts; filaments none; pistillate fls. pedicelled, solitary in the axils of lvs.; perianth top-shaped, in 2 divisions: ovary 1-celled, 1-ovuled: style large, club-shaped.

In order to secure a good setting of berries, one or two staminate plants should be placed near every group of a dozen pistillate ones. When the shrubs are without berries the expert nurseryman can distinguish the two sexes by the more upright growth of the staminate and the more twiggy growth of the pistillate plants. The redder the berries the better for ornamental purposes. The berries are somewhat poisonous, but are eaten by birds. Though essentially a seashore plant, it is easily cult. inland in common garden soil, and thrives even in barren, sandy lands. It inhabits cool moving sands and the alluvium of torrents. When grown abroad to hold shifting sands it makes a straggling, stunted bush 2 ft. or more high. Under favorable conditions it may be grown into a tree 20 ft. high. The suckers may become so numerous as to be troublesome. The numerous spines which terminate the branches and the interlacing stems suggest its use for hedges. It is propagated by layers, suckers, root-cuttings and seeds.

rhamnoides, Linn. Sea Buckthorn. Swallow Thorn. Lvs. appearing before the fls., grayish green above, silvery green below and scattered with reddish scales below: fls. yellowish, borne in clusters of 2–3 in May: fr. berry-like, orange-yellow, acid, maturing in Sept. G.M. 37:791. Gn. 49:1050 (with a fine colored plate and thorough appreciation by W. Goldring), and 54, p. 396.

H. salicifòlia, D.Don, has larger lvs., less densely coated with silvery scales. Nepal. Not cult. A. P. Wyman.

HOBBLEBUSH. *Viburnum lantanoides.*

HOES. See *Tools.*

HOFFMÁNNIA (Georg Franz Hoffmann, 1760–1826, professor of botany at Göttingen). Including *Campylobòtrys* and *Higginsia*. *Rubiàceæ*. About 15 tropical American herbs or shrubs, with opposite or verticillate lvs. and small white, yellow or red fls., cult. for the very showy foliage. Corolla tubular, with 4 (rarely 5) oblong or linear obtuse lobes; stamens 4: ring-like disk about the 2–3-loculed ovary: style filiform, the stigma 2-lobed. The Hoffmannias require warm temperature, although they may be plunged in the open in the summer. Well grown specimens are also adapted to the decoration of window-gardens and living rooms. Propagated by cuttings. Hoffmannias are very showy foliage plants.

A. *Fl.-clusters on long stalks.*

discolor, Hemsl. (*Campylobòtrys discolor,* Hook.). Fig. 1071. About 6 in high, but lopping over the side of the pot or pan and making a mat, slightly hairy, the branches purplish: lvs. short-petioled, oblong-obovate, entire, satiny green above and rich light purple to green beneath: fls. small, red, in recurving racemes, on red peduncles. Mex. B.M. 4530.—Excellent little plant.

1071. Hoffmannia discolor (× ⅓). A loose-growing sprig.

refúlgens, Hemsl. Much like the former, but twice or more as large, the lvs. sessile and almost succulent, narrow-obovate, with many parallel veins running from the midrib to the margin, the under surface pale red or wine color and the upper surface dull green, with iridescent shades of purple and brown: fls. 1 in. across, pale red. Mex. B.M. 5346 as *Higginsia refulgens.*—A most beautiful plant.

AA. *Fl.-clusters crowded in the axils.*

Ghièsbreghtii, Hemsl. Half shrubby, 2–4 ft. tall, nearly glabrous: stem acutely 4-angled: lvs. usually 1 ft. or less long, oblong-lanceolate-acuminate, entire, the short winged petiole somewhat decurrent, very strongly veined, purple-red beneath and dark velvety green above: fls. yellow, with a red spot in the center. Mex. B.M. 5383 as *Higginsia Ghiesbrechtii.* I.H. 8:279, as a Campylobotrys.—A form with handsomely mottled lvs. is var. **variegàta,** Hort. (I.H. 30:498).

regàlis, Hemsl. Shrubby, strong-growing, glabrous, the branches obtusely 4-angled and somewhat fleshy: lvs. large, round-ovate and abruptly acuminate, entire, plicate with arched nerves, glabrous, purple-red beneath and dark rich green above: fls. yellow, sessile. Mex. B.M. 5280, as a Higginsia.

Higginsia Rœzli, Hort., is described as "a very beautiful new tropical plant, with dark bronzy leaves, streaked and marbled with white." *Saul.* L. H. B.

HOHENBÉRGIA (personal name). *Bromeliàceæ.* Species commonly referred to Æchmea, but the latest monographer (Mez, DC. Monogr. Phaner. 9) retains 17 species under this genus. The genus differs from Æchmea in technical floral characters, the petals being ligulate, fls. always sessile and small, etc. **H. Legrelliàna,** Baker, is by Mez referred to Æchmea (*Æ. Lagrelliàna,* Mez) and by Bentham & Hooker to Portea. It has also been referred to Ortgiesia. It is a strong Billbergia-like plant, with 7–12 strong, entire, brown-scaly lvs. and a simple dense spike of red fls. standing 4–7 ft. high: floral bracts serrate. Uruguay. For *H. ferruginea,* see *Æchmea.* Warmhouse. L. H. B.

HOLBŒLLIA (Frederick Louis Holbœll, once Supt. Bot. Gard., Copenhagen). *Berberidàceæ.* This genus contains a fine shrubby climber, which is unfortunately inferior in hardiness to *Akebia quinata,* the latter being one of the best of all hardy vines. Holbœllia resembles Akebia in having digitate lvs., edible, oblong, indehiscent berries and an indefinite number of ovules. It differs in having 6 sepals and 6 minute petals, while Akebia has 3 sepals and no petals. Both genera have free stamens, while those of Stauntonia are monadelphous. Holbœllia has only 1 species. Generic characters are: fls. purple or greenish, monœcious; sepals 6, petal-like; staminate fls. with rudimentary ovaries; pistillate fls. with 6 very small, sterile stamens.

Any one who was surprised with the "discovery" of the strange purple fls. of Akebia will be interested in the fls. of Holbœllia. These are also purple or vary to greenish white, and the staminate fls., which appear later, are highly fragrant. The plant should be tried outdoors in the South where an evergreen quick-growing climber is desired, as it makes annual shoots 10 to 12 ft. long, and the foliage is distinct and beautiful. For the cool greenhouse it is too rampant and produces too few fls.

latifòlia, Wallich. Leaflets commonly 3 or 5, but very variable in form and number. Himalayas. B.R. 32:49. R.H. 1890:348. Gn. 8, p. 548, and 14, p. 369. W. M.

HÒLCUS (Greek, *to draw out;* an old fable crediting this plant with the power of drawing thorns from the flesh). *Gramineæ.* About 8 species of annual or perennial tufted grasses from Europe and Africa. The only species cult. is a forage grass of poor quality but capable of growing well in dry soil. Its nearest allies of garden value are Avena and Deschampsia, from which it differs as follows: spikelets falling off whole, and glumes with no or minute awns. Avena and Deschampsia have the floral glumes decidedly awned and the empty glumes remain on the plant when the florets fall.

lanàtus, Linn. Meadow Soft Grass. Perennial, 2–3 ft. high: lvs. downy: panicle greenish or tinged purple. Eu. A variegated form is cult. abroad for ornament.

G. T. Hastings.

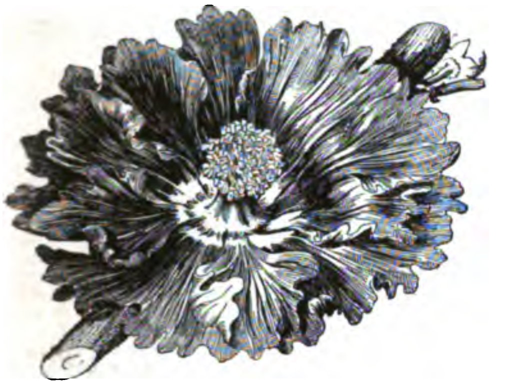
HOLLY. Consult *Ilex.*

HOLLY, SEA. *Eryngium.*

HOLLYHOCK (*Althæa rosea* which see). Figs. 1072–4. The Hollyhock is an old garden favorite, full of sentiment and association with a distant past, and only the ravages of a dire disease have robbed it of the proud position it held among garden flowers during the middle of the present century. A plant of strong, vigorous growth, noble aspect, and of the most ornamental character, it must not be neglected or ignored, for we can ill dispense with its stately beauty. Before the ravages of disease there were in existence large collections of named varieties, and the Hollyhock was then one of

1072. The Hollyhock.

the most important of flowers. Within recent years, too, either from loss of virulence or through preventive measures, the disease having been somewhat controlled, collections of named varieties are again being formed, but, in the light of his own experience, the writer believes that one can get the best and surest results by raising plants from seed of a good strain. This may be sown at any time during the early months of the year. Sow in pots or pans and place in a warmhouse to assist germination. Pot the plants singly as they develop, and keep them growing freely but sturdily in a cool, airy temperature, removing them to the open air as summer advances. If well grown, the plants should be in 6-in. pots at this time. During the latter part of summer they may be planted out where they are to bloom. As Hollyhocks demand liberal treatment, their permanent spot should be well prepared by deep digging, at the same time working in a good quantity of rotted manure. Plant 3 ft. apart and firmly, and should the fall months be dry, give water frequently, as suffering from drought predisposes plants to attack of disease. The following spring the plants will grow vigorously, and the only attention needed is copious watering during dry spells. The flowers will appear from July onwards. The Hollyhock is a hardy perennial, and if it enjoys an immunity from disease, will spring up and flower each year. Should disease appear, however, root the plants out and destroy by fire and make the next plantation on a new site some distance removed. Thorough spraying with fungicides may be expected to hold the disease in check, if applications are made early and to the under sides of the lvs.; but if Bordeaux mixture is used, the plants look very untidy. Perhaps it is better to use ammoniacal carbonate of copper. A diseased leaf is shown in Fig. 880. If the stock keeps healthy and it is desired to increase specially fine varieties, this can be done easily by cuttings formed from offshoots. These should be taken off and potted singly in small pots in sandy soil and kept close in a shaded coldframe.


1073. Semi-double Hollyhock (× ½).

1074. Double Hollyhock (× ½).

A few fine named varieties obtainable in the trade at present are: Apollon, rose; Brennus, crimson; Ettie Beale, flesh pink; Mrs. Barron, rose-pink, and very beautiful; Diadem, rich yellow; Her Majesty, rose; Enchantress, yellow; Ochroleuca, light yellow; Queen, silver-rose; Venus, white; Psyche, lavender. Figs. 245 and 246, vol. 1, show good placing of Hollyhocks.

A. Herrington.

HOLY GHOST PLANT. *Peristeria elata.*

HOMALÁNTHUS (application obscure). *Euphorbiàceæ.* This genus includes a small Australian tree or tall shrub cult. in S. Calif. for its copper-colored foliage. It is probably slightly cult. abroad under glass like *Euphorbia pulcherrima.* The genus contains 5–8 species of Malayan and Australasian trees or shrubs: lvs. alternate, stalked, wide, entire, feather-veined: racemes terminal: fls. apetalous; disk none; calyx of staminate fls. 2-parted; stamens 6–50; calyx of pistillate fls. 2–3-fid: ovary 2-celled.

The genus has no near allies of garden value, and the fls. are insignificant, being borne in racemes which consist mostly of staminate fls., with a few pistillate fls. at the base.

Leschenaultiànus, A. Juss. (*H. populifòlius,* R. Grah. *Carúmbium populifòlium,* Reinw.). Lvs. broadly ovate-triangular or rhomboidal, glaucous, 2–4 or even 6 in. long, with stalks of same length: racemes 1–4 in. long. India, Malaya, Australia. B.M. 2780.

HOMALOMÈNA (Greek, *equal filaments*). *Aràceæ.* Also written *Homalonema.* This genus includes some tender foliage plants, variegated after the fashion of the well-known Dieffenbachias, and the rarer Aglaonema and Schismatoglottis. It is probable that the plants seldom produce flowers or fruit in cultivation. They are known to the trade as Curmeria, which is now regarded as a section of Homalomena in which the spathe has a distinct tube and the lvs. are either glabrous or pilose, while in the section Euhomalomena the spathe has an indistinct tube, and the lvs. are always glabrous.

The genus has about 15 species, natives of tropical Asia and America: robust herbs, with a thick rhizome: stem short or none: lvs. ovate- or triangular-cordate, or lanceolate, nerves reaching the margin, petiole mostly long and sheathing. Important generic characters are: stamens distinct: fr. included within the persistent spathe: ovules anatropous, adnate to the septa. For culture, see *Dieffenbachia.* Latest Monograph by Engler in DC. Mon. Phan. 2:332(1879). The species described below belong to the subgenus Curmeria, with 3 other species, and all are American; the other 10 species are Asian.

Pitcher and Manda advertised in 1895 *Curmeria Leopoldii,* a rare and costly plant, of which the writer finds no further information.

A. *Lvs. irregularly blotched.*

Wállisii, Regel (*Curmèria Wállisii,* Mast.). Lvs. glabrous throughout, the base obtuse or acute, not notched; petiole 1½ in. long; blade 5 in. long, 2–2½ in. wide. Colombia. G.C. II. 7:108. B.M. 6571 (midrib outlined in light color). I.H. 25:303. R.H. 1878, p. 193.—The blotches are pale yellowish green, becoming greenish gray. None of the pictures show a white-bordered leaf with golden blotches, as one dealer advertises.

AA. *Lvs. with midrib bordered with white.*

picturàta, Regel (*Curmèria picturàta,* Linden & André). Lvs. with petiole and midrib pilose; petiole 4 in. long; blade 10–12 in. long, 8 in. wide. Colombia. I.H. 20:121.—Blotched only near the midrib.

W. M.

HOMÈRIA (application uncertain). *Iridàceæ.* This includes a half-hardy bulb, which can be set out in spring, and bears orange-colored fls. in summer. It is allied to Sparaxis, requires the same culture, and the bulbs, which are dormant from Aug. to Nov., are procurable from Dutch dealers. A genus of 6 species, all from the Cape of Good Hope. It belongs to the Moræa tribe, in which the fls. are stalked and more than one to a spathe, and the style branches placed opposite the stamens. It differs from Iris and Moræa in having style branches furnished with terminal stigmas not overtopping the anthers. Nearer allies of garden value are Tigridia, Herbertia and Ferraria, from all of which

Homeria differs in the 2 petaloid stigmatose crests at the ends of the style branches. Homeria has 6 nearly equal perianth segments, which at the base are united into a cup. Monogr. by J. G. Baker in Handbook of the Irideæ, 1892, and Flora Capensis 6:26 (1896–7). The following characters successively delimit *H. collina* from the other 5 species: perianth segments not blotched in the middle: fls. large: spathes 2½–3 in. long: lvs. not banded down the middle. W. E. Endicott writes that *H. collina* does well when treated like Ixia, as described by him in this work.

collina, Vent. (*Moræa collina*, Thunb.). Corm tunicated, globose, ¾–1 in. long: the only long leaf is linear, rigid, 1½–2 ft. long, overtopping the fls.: stem bearing 1–4 clusters of fls.: perianth segments 1¼–1½ in. long, typically bright red, as in B.M. 1033; G.C. III. 4:163. Var. **aurantiaca** has a slenderer habit and yellow-clawed, bright red segments, which are narrower and more acute than the type. B.M. 1612. Var. **ochroleùca** has the habit of the type and pale yellow fls. B.M. 1103. It is probable that var. *aurantiaca* is the only form in which the species is cultivated.

HOMOCÉLTIS, a name in the Amer. trade, is a misspelling of *Homoioceltis*. P. J. Berckmans writes that seeds of *Homoceltis Japonica* were distributed some 20 years ago by Gen. Wm. Browne, then a professor at the Georgia State University. These trees were injured in Georgia by the severe cold of February, 1899. Reasoner writes that it is a fine, deciduous tree, with the appearance of an elm or hackberry, and makes a dense top. It has not flowered in Florida.

Homoioceltis aspera, Blume, is *Aphananthe aspera* (which see), and this is the only Homoioceltis in Japan. Some, at least, of the stock known as *H. Japonica* (and sometimes called also *Celtis Davidiana*) is *Aphananthe aspera*. In Aphananthe, the secondary veins are straight and end the teeth of the lvs.; in Celtis, they are curved and form loops along the margin.

HONESTY. *Lunaria annua.*

HONEY LOCUST. *Gleditschia triacanthos.* **Honeysuckle,** *Lonicera.* **Honeywort,** *Cerinthe.*

HOOKERA. A part of *Brodiæa.*

HOP. See *Humulus.*

HOP HORNBEAM. See *Ostrya.* **Hop, Wild,** *Bryonia dioica.*

HOPLOPHỲTUM. Several Bromeliads have been described under this name, but the species are now referred to *Æchmea*. *Halophytum* of one trade catalogue is apparently an error for *Hoplophytum*.

HÓRDEUM (Latin, *heavy;* because barley bread is heavy and firm). *Gramíneæ.* This genus includes the Barley (*H. sativum*) and the Squirrel Tail Grass (*H. jubatum*), the latter a meadow weed obnoxious in the West, but sometimes cult. for ornament in the East and abroad. Its head of long spreading awns is ornamental, but the spikelets separate too readily to make the grass particularly desirable. Hordeums are erect, annual or perennial grasses, spikelets in 3's, sessile on opposite sides of the notched rachis, empty glumes narrow and long, forming an involucre around the spikelets. In these characters it resembles Elymus and Asprella, but it is separated from them by the fact that each spikelet is but 1-fld., while in the others the spikelets are 2–many fld. See *Barley*.

jubàtum, Linn. SQUIRREL-TAIL GRASS. WILD BARLEY. Erect, simple, usually smooth and glabrous, 10 in. to 2 ft. high: lvs. 1–5 in. long, only the central spikelet in each cluster perfect: awns of empty glumes 1–2½ in. long, spreading. In dry soil, northern U. S. and Canada. B.B. 1:229. R.H. 1890, p. 488 (poor).

G. T. HASTINGS.

HOREHOUND. See *Marrubium.*

HORMÌNUM. See *Salvia.*

HORNBEAM. Consult *Carpinus.*

HORNED POPPY. *Glaucium.*

HORSE, in combination with other names of plants, usually signifies something large and coarse, not necessarily eaten by horses.

HORSE BALM. *Collinsonia.*

HORSE BEAN. See *Vicia Faba.*

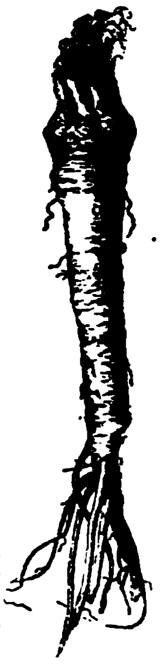
HORSE CHESTNUT. See *Æsculus*

HORSE MINT. See *Monarda.*

HORSE-RADISH (Fig. 1075), the well-known condiment used so much with roast beef and oysters, is a member of the natural family Cruciferæ, to which belong cabbage, turnip, wallflower, stock, charlock, mustard, and many other vegetables, flowers and weeds. It comes to us from Great Britain, where it is thought to have been naturalized from some more eastern European country. It is often found growing wild in moist locations, such as the margins of streams, in cool woods and damp meadows, and, in some places, notably in the state of New York, is troublesome as a weed. For botanical description, see *Cochlearia.*

The root is perennial, fleshy, whitish externally, pure white within, conical at the top, cylindrical, and, unlike the tap-roots of parsnips, is abruptly branched below. When bruised, it emits a volatile oil of strong, pungent odor and hot, biting taste. If eaten before this oil evaporates, it "is highly stimulant, exciting the stomach when swallowed, and promoting the secretions, especially that of urine. Externally, it is rubefacient. Its chief use is as a condiment to promote appetite and invigorate digestion; but it is also occasionally employed in medicine." (U.S. Dispensatory.) As a table relish, the consumption of Horse-radish is increasing, and greater attention is being paid to its cultivation than formerly. Under the old methods, profitable returns were often obtained, but under the new, profits are generally highly satisfactory where enemies are not very troublesome. The season of fresh-grated Horse-radish runs almost parallel to that of oysters, with which the root is most frequently eaten in this country. Ungrated roots are, however, kept in cold storage for summer use, since roots dug at that season have an unpleasant taste.

Horse-radish will do well upon almost any soil except the lightest sand and the heaviest clay, but a deep loam of medium texture and moderate richness, well supplied with humus and moisture, will produce roots of the best quality and the largest size. In dry soils the roots will be small, woody and deficient in pungency; in wet, small, succulent, strong-tasting. Drainage is essential, and so is a fairly open subsoil. Hard subsoil induces excessive branching of the root. Applications of nitrogenous manures should be rather light, commercial fertilizers rich in potash being given the preference. Rolfs recommends a mixture containing 10 per cent potash, 7 per cent phosphoric acid, 4 per cent nitrogen, 600 pounds drilled in per acre. A heavier application broadcast and deeply plowed under, it is believed, would give better results, since the shaft of the root is less likely to become unduly branched when the food is below instead of above and around it, especially when the sets are placed horizontally. A weeder should be used after the harrow periodically until the plants are an inch or so tall. Thorough preparation of the soil is essential.



1075. Good root of Horse-radish.

Since Horse-radish rarely produces seeds, cuttings

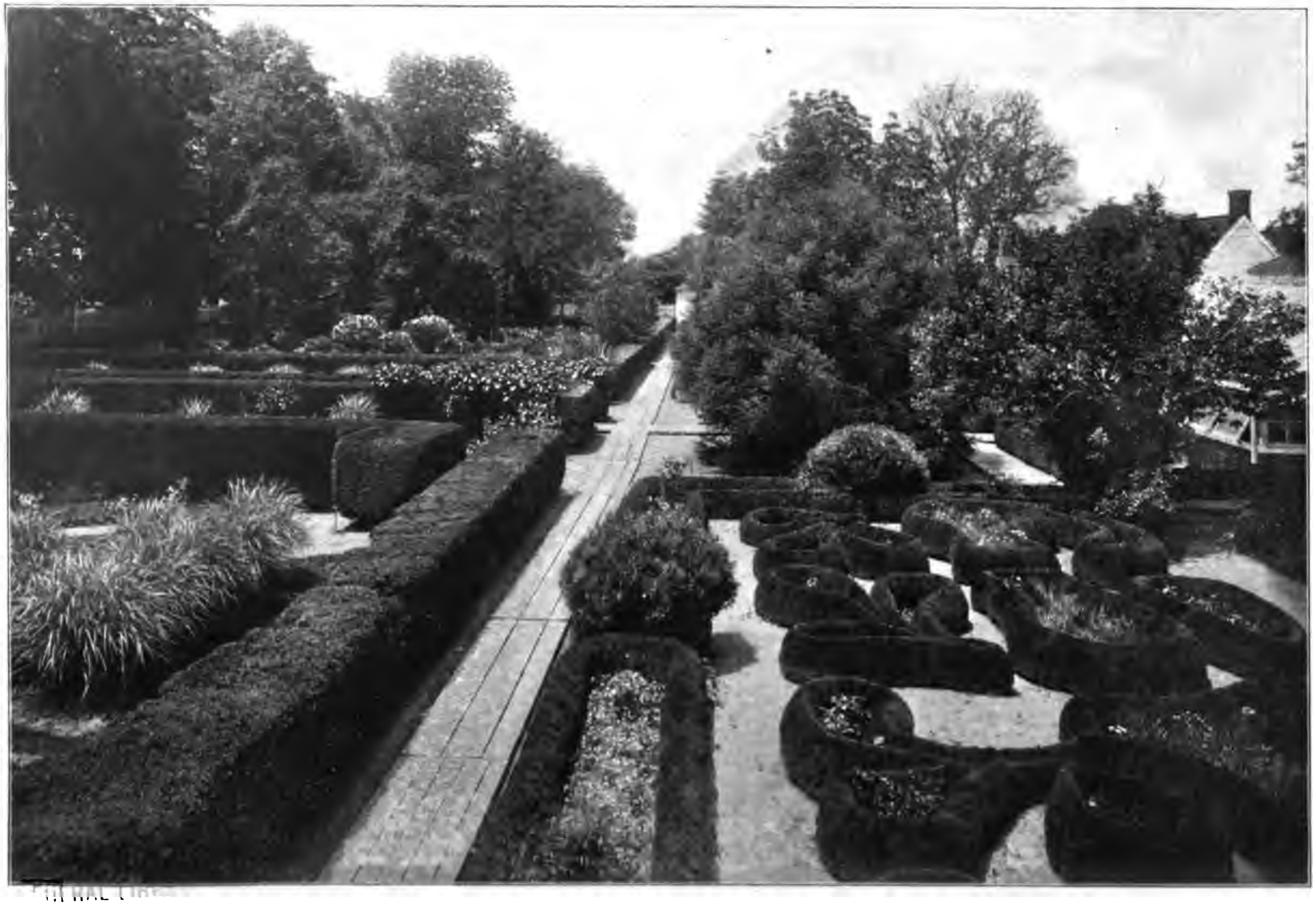
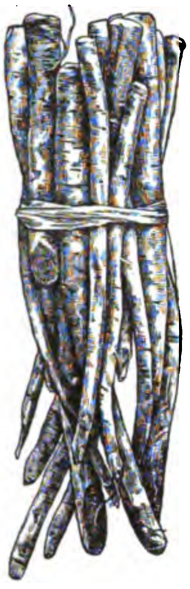


Plate XIV. Type of an old-time formal garden. Washington's garden at Mt. Vernon, as it looks to-day.

are made from the roots, not less than one-fourth of an inch thick and 4-5 in. long (Fig. 1076). To facilitate planting the large-end up, the upper end is cut off square and the lower oblique. If set small-end up no growth may result. In horizontal planting this special cutting is unnecessary. Root-crowns are sometimes used, but since these develop a large number of roots too small for profitable grating, they are employed only for increasing stock.

The land having been prepared, shallow furrows are laid off 30 in. apart and 2-5 in. deep, according to the method of planting. Sets are planted horizontally, vertically, and at all intervening angles, the large ends being made to point in one direction to facilitate cultivation and digging. The angle is a matter of choice, good returns being obtained in each. The usual distance between sets is about 12 in. Cultivation is given after every rain, or once in 10 days, until the lvs. shade the ground.


1076. Root cuttings of Horse-radish (× ⅓).

Double-cropping is common in Horse-radish growing, early cabbage, turnip beets and other quick-maturing plants being used. The sets are dibbled in 2-4 weeks after the first crop, vertically, 18 in. asunder, between the rows of cabbage, which are not less than 2 ft. apart. One management answers for both crops until the first is removed, when, after one cultivation, the Horse-radish usually takes full possession. Deep burying of the sets at the time the first crop is planted is also practiced, the object, as in the first case, being to prevent the appearance of the former until the latter is almost mature.

Horse-radish makes its best growth in the cool autumn, steadily improves after September, and, not being injured by frost if undug, is usually left until late before harvesting with plow or spade. Storage in pits is best, since the roots lose less of their crispness, pungency and good appearance than if stored in cellars. In trimming for storage, the lateral roots are saved and buried for next season's planting. Exposure to air, sun and frost robs the roots of their good qualities and injures their vitality.

The insect enemies of this plant are those that attack other members of the cabbage family, the harlequin bug being the most dreaded. Remedies are the same as for other pests of this group of plants. Only two diseases have been reported, and these are seldom troublesome.

In the neighborhood of cities, especially where oysters are cheap, this crop is generally profitable, the usual retail price being 10 cents per pint, freshly grated, but without vinegar. This quantity weighs a scant half-pound. The cost of growing per acre is about as follows: Cuttings (10,000 @ $2), $20; fertilizer (1,000 lbs.), $17.50; cultivation (6 times), $6; rent of land, $5; plowing, wear of tools, etc., $3.50; setting roots, at 30 cents per 1,000, $3; total, $55. A marketable crop varies from 3,000 to 6,000 pounds, which may sometimes be sold as high as 5 cents per lb. for first-class root, and 2½ cents for second grade. Usually, however, prices seldom rise above 4 cents and 2 cents for the two grades. Under good cultivation, the proportion of No. 1 to No. 2 root is about 1 to 1 by weight. Lower prices may rule in well supplied markets, and higher in poorly furnished, and when sold in small lots to retail graters, even 7 cents may be obtained.

M. G. KAINS.

HORSE-RADISH TREE. *Moringa pterygosperma.*

HORSE SUGAR. *Symplocos tinctoria.*

HORSETAIL. *Equisetum.*

HORSEWEED. *Collinsonia.*

HORTICULTURE (*hortus* a garden, originally an inclosure; *cultura*, to care for or to cultivate). Horticulture is the growing of flowers, fruits and vegetables, and of plants for ornament and fancy. Incident to the growing of the plants are all the questions of plant-breeding, variation of plants under domestication, and the bearings and applications of many biological and physical sciences. Primarily it is an art, but it is intimately connected with science at every point. From agriculture it has no definite boundary. It is, in fact, a department of agriculture, as forestry is; for agriculture, in its largest meaning, is the business of raising products from the land. It is customary, however, to limit the word agriculture to the growing of grains, forage, bread-stuffs, textiles, and the like, and to the raising of animals. In this restricted application it is practically coördinate, in a classificatory sense, with forestry and Horticulture. Etymologically, agriculture is the tending of the fields (*agri*, field) or those parts which, in earlier times, lay beyond the fortified or protected inclosure, or at least more or less remote from the residence; Horticulture was concerned with the area within the inclosure. Equivalent to Horticulture in etymology is *gardening* (Anglo-Saxon *gyrdan*, to enclose, to which the verb *to gird* is allied). By custom, however, *garden* and *gardening* denote more restricted areas and operations than are implied in the term Horticulture. The word *paradise* is connected with the idea of an inclosure and a garden. Early gardening books of the Cyclopedia type are sometimes known as *paradisæ*. Parkinson's famous Paradisus, or account of "a garden of all sorts of pleasant flowers," was published in England in 1629.

The only demarcation between Horticulture and agriculture is the line of custom. Sweet potatoes are usually considered to be a horticultural crop in North America, particularly in the northern states, but round or Irish potatoes are usually classed as an agricultural crop. Nor is there a definite division between Horticulture and botany. The science of plants is botany; yet some of the most significant problems relating to plants—their response to the needs of man—are ordinarily resigned by the botanist to the horticulturist. Horticulture is a composite of botanical and agricultural subjects.

But Horticulture is more than all this. It is a means of expressing the art-sense. Plant-forms and plant-colors are as expressive as the canvas work of the painter. In some respects they are more expressive, since they are things themselves, with individuality and life, not the suggestions of things. The painter's work excels in its power to suggest, and in its condensed portrayal of expression. But the essentials of a good landscape painting often can be presented in an artificially-made landscape. This effort to plant what the artist paints is modern. It is strictly not Horticulture, although Horticulture is contributory to the results, as paint-making is contributory to painting. Landscape making is fundamentally a fine art. In this work it is treated under *Landscape Gardening.*

Horticulture divides itself into four somewhat coördinate branches (Annals Hort. 1891, 125-130):

- Pomology, or the growing of fruits;
- Olericulture, or vegetable-gardening;
- Floriculture, or the raising of ornamental plants for their individual uses or for their products;
- Landscape Horticulture, or the growing of plants for their use in the landscape (or in landscape gardening).

In the world at large, floriculture is the most important as measured by the number of people who are interested, and by the number of species of plants which are grown (see *Floriculture*). In North America, pomology is the most important in respect to commercial supremacy. North America is the great fruit-growing country of the world (see *Pomology*). Relatively speaking, vegetable-gardening is undeveloped in the New World. Landscape Horticulture and landscape gardening will appeal to a constantly enlarging constituency with the growth of culture and of leisure and the deepening of the home life.

Strictly speaking, there are few horticulturists. The details are too many to allow any one person to cover the entire range. It is only those who look for principles who survey the whole field. Practitioners must confine themselves to rather close bounds. Consider that no less than 25,000 species of plants are in cultivation, each having its own requirements. Consider the great number of species which are actually on sale in North America, as registered in this Cyclopedia. The most important species vary immensely, the named and recorded forms often running into the thousands; and each of these forms has particular merits and often particular requirements. Consider that the requirements are likely to be different in any two places, and that the plants are profoundly modified by changes in conditions or in treatment. Consider the vagaries of markets, which are ruled by questions of fancy more than by questions of necessity. There is probably no art in which the separate details are so many as in Horticulture.

Of Horticulture there are two general types,—that which is associated immediately with the home life, and that which is undertaken primarily for the gaining of a livelihood. The former is amateur Horticulture. Those things are grown which appeal to the personal tastes: they are grown for oneself. The latter is commercial Horticulture. Those things are grown which the market demands: they are grown for others. In all countries, commercial Horticulture is a relatively late development. General agriculture is usually the primary means of earning a living from the soil. For the most part, Horticulture comes only with the demand for the luxuries and refinements of life: it does not deal with what we call the staples. It is not the purpose of this sketch to trace the general history of Horticulture. If one desires such outlines, he should consult the Bohn edition of Pliny's "Natural History;" Loudon's "Encyclopædia of Gardening;" G. W. Johnson's "History of English Gardening;" Amherst's "History of Gardening in England;" Sieveking's "Gardens, Ancient and Modern;" Jäger's "Gartenkunst und Gärten, sonst und jetzt;" Hüttig's "Geschichte des Gartenbaues;" the historical chapters of André's "L'Art des Jardins." For the histories of cultivated plants, see DeCandolle's "Origin of Cultivated Plants;" Hehn & Stallybrass' "Wanderings of Plants and Animals from their first Home;" Pickering's "Chronological History of Plants."

In North America there was little commercial Horticulture before the opening of the nineteenth century. There were excellent home gardens more than a century ago, in which many exotic plants were growing; yet, in proportion to the whole population, these gardens were isolated. The status of any modern time is accurately reflected in its writings. It may be well, therefore, to bring in review the leading early horticultural writings of this country. Few studies have been made of our horticultural history. The best is the introductory sketch, by Robert Manning, in the "History of the Massachusetts Horticultural Society," 1880. For its field, Slade's "Evolution of Horticulture in New England," 1895, is interesting. In a still narrower field, Boardman's "Agricultural Bibliography of Maine" is critical and invaluable. The chapter on "American Horticulture," by Alfred Henderson, in Depew's "One Hundred Years of American Commerce," 1895, presents the commercial side of the subject. Another fragment of the history is presented in the writer's "Sketch of the Evolution of our Native Fruits," 1898. Histories from several points of view are presented in the "Florists' Exchange" for March 30, 1895; and the writer has incorporated parts of his own contribution to that history in the sketch which follows.

The earliest writings on American plants were by physicians and naturalists who desired to exploit the wonders of the newly discovered hemisphere. The earliest separate writing is probably that of Nicolo Monardes on the products of the New World, which was published in Seville in parts, from 1565 to 1571. The completed treatise was translated into Italian, Latin, English and French. Monardes is now remembered to us in the genus Monarda, one of the mint tribes. He wrote of the medicinal and poisonous plants of the West Indies, and gave pictures, some of them fantastical. His picture of tobacco is not greatly inaccurate, however; and it has the distinction of being probably the first picture extant of the plant, if not of any American plant. This picture is here reproduced (Fig. 1077) exact size, to show the style of illustration of three hundred years ago. Jacques Cornutus is generally supposed to have been the first writer on American plants. His work, "Canadensium Plantarum," appeared in 1635, and it also had pictures. One of the earliest writers on the general products and conditions of the northern country was John Josselyn, who, in 1672, published a book entitled "New England's Rarities discovered in Birds, Beasts, Fishes, Serpents, and Plants of that Country," and in 1674 a second volume, "An Account of Two Voyages to New England, made during the years 1638, 1663." The "Rarities" gives specific accounts of many plants, together with pictures of a few of them, as, for example, the pitcher plant. He mentions the plants which had become naturalized from Europe. There is also a list "Of such Garden Herbs (amongst us) as do thrive there, and of such as do not." This list, the earliest record of the kind, is here transcribed:

Cabbidge growes there exceeding well.
Lettice.
Sorrel.
Parsley.
Marygold.
French Mallowes.
Chervel.
Burnet.
Winter Savory.
Summer Savory.
Time.
Sage.
Carrats.
Parsnips of a prodigious size.
Red Beetes.
Radishes.
Turnips.
Purslain.
Wheat.
Rye.
Barley, which commonly degenerates into Oats.
Oats.
Pease of all sorts, and the best in the World; I never heard of, nor did see in eight Years time, one Worm eaten Pea.
Garden Beans.
Naked Oats, there called Silpee, an excellent grain used instead of Oat Meal, they dry it in an Oven, or in a Pan upon the fire, then beat it small in a Morter.
Spear Mint.
Rew, will hardly grow.
Fetherfew prospereth exceedingly.
Southern Wood, is no Plant for this Country. Nor
Rosemary. Nor
Bayes.
White Satten groweth pretty well, so doth
Lavender Cotton. But
Lavender is not for the climate.
Penny Royal.
Smalledge.
Ground Ivy, or Ale Hoof.
Gilly Flowers will continue two Years.
Fennel must be taken up, and kept in a warm Cellar all Winter.
Housleek prospereth notably.
Holly hocks.
Enula Campana, in two Years time the Roots rot.
Comferie, with white Flowers.
Coriander, and
Dill, and
Annis thrive exceedingly, but Annis Seed, as also the Seed of Fennel, seldom come to maturity; the Seed of Annis is commonly eaten with a fly.
Clary never lasts but one Summer, the Roots rot with the Frost.
Sparagus thrives exceedingly, so does
Garden Sorrel, and
Sweet Bryer, or Eglantine.
Bloodwort but sorrily, but
Patience, and
English Roses, very pleasantly.
Celandine, by the West Country men called Kenning Wort, grows but slowly.
Muschata, as well as in England.
Dittander, or Pepper Wort, flourisheth notably, and so doth
Tansie.
Musk Mellons are better than our English, and
Cucumbers.
Pompions, there be of several kinds, some proper to the Country, they are dryer then our English Pompions, and better tasted; you may eat them green.

Tuckerman comments as follows on the above lists: "The earliest, almost the only account that we have of the gardens of our fathers, after they had settled themselves in their *New* England, and had tamed its rugged coasts to obedience to English husbandry. What with their garden beans, and Indian beans, and pease ('as good as ever I eat in England,' says Higginson in 1629); their beets, parsnips, turnips, and carrots ('our turnips, parsnips, and carrots are both bigger and sweeter than is ordinary to be found in England,' says the same reverend writer); their cabbages and asparagus,—both thriving, we are told, exceedingly; their radishes and lettuce; their sorrel, parsley, chervil, and marigold, for pot-herbs; and their sage, thyme, savory of both kinds, clary, anise, fennel, coriander, spearmint, and pennyroyal, for sweet herbs,—not to mention the Indian pompions and melons and squanter-squashes, 'and other odde fruits of the country,'—the first-named of which had got to be so well approved among the settlers, when Josselyn wrote in 1672, that, what he calls 'the ancient New-England standing dish' (we may call it so now!) was made of them; and, finally, their pleasant, familiar flowers, lavender-cotton and hollyhocks and satin ('we call this herbe, in Norfolke, sattin,' says Gerard; 'and, among our women, it is called honestie') and gillyflowers, which meant pinks as well, and dear English roses, and eglantine,—yes, possibly, hedges of eglantine,—surely the gardens of New England, fifty years after the settlement of the country, were as well stocked as they were a hundred and fifty years after. Nor were the first planters long behindhand in fruit. Even at his first visit, in 1639, our author was treated with 'half a score of very fair pippins,' from the Governor's Island in Boston Harbor; though there was then, he says, 'not one apple tree nor pear planted yet in no part of the countrey but upon that island.' But he has a much better account to give in 1671: 'The quinces, cherries, damsons, set the dames a work. Marmalad and preserved damsons is to be met with in every house. Our fruit trees prosper abundantly,—apple trees, pear trees, quince trees, cherry trees, plum trees, barberry trees. I have observed, with admiration, that the kernels sown, or the succors planted, produce as fair and good fruit, without grafting, as the tree from whence they were taken. The countrey is replenished with fair and large orchards. It was affirmed by one Mr. Woolcut (a magistrate in Connecticut Colony), at the Captain's messe (of which I was), aboard the ship I came home in, that he made five hundred hogsheads of syder out of his own orchard in one year.'—*Voyages*, p. 189–90. Our barberry bushes, now so familiar inhabitants of the hedgerows of eastern New England, should seem from this to have come, with the eglantines, from the gardens of the first settlers. Barberries 'are planted in most of our English gardens,' says Gerard." Relics of Josselyn's time still persist in old apple trees in New England (Fig. 1078). The foregoing lists and remarks show that the colonists early brought their familiar home plants to the new country: and there are many collateral evidences of the same character. There was long and arduous experimenting with plants and methods. Several things which were tried on a large scale failed so completely, either from uncongenial conditions or for economic reasons, that they are now unknown to us as commercial crops; amongst these are indigo, silk and the wine grape. The histories of these things can be traced only as a refrain is cotemporary writing. Indian corn, tobacco and cotton early became the great staple crops.

The Indians cultivated corn, beans, pumpkins and other plants when America was discovered. They soon adopted some of the fruits which were introduced by the colonists. William Penn and others found peaches among the Indians. Orchards of peaches and apples were found in western New York by Sullivan's raid against the Six Nations in revolutionary times. Josselyn, Roger Williams, Wood and others speak of the corn and squashes of the Indians. The word squash is adopted from the Indian name, *squontersquash*, *askutasquash*, or *isqoutersquash*. C. C. Jones, in his "History of Georgia," in describing the explorations of De Soto, says that before reaching the Indian town of Canasagua (whose location was in Gordon county, Georgia), DeSoto "was met by twenty men from the village, each bearing a basket of mulberries. This fruit was here abundant and well flavored. Plum and walnut trees were growing luxuriantly throughout the country, attaining a size and beauty, without planting or pruning, which could not be surpassed in the irrigated and well-cultivated gardens of Spain." For critical notes on the plants cultivated by the American aborigines, see Gray and Trumbull, Amer. Journ. of Science, vol. 25 (April, May), vol. 26 (August).

"Fruit-growing among the Indians of Georgia and Alabama in the early history of these states," writes Berckmans, "is demonstrated by the large quantity of peaches which the Indian traders of the early colonial period found growing in the Creek, Cherokee and Choctaw villages. It is on record that Indians often made long trips to other tribes for exchanging various articles of their making, and thus the seed from those peach trees was undoubtedly procured from the Florida Indians, who, in turn, procured these from the trees planted by the Spanish explorers. The peculiar type of 'Indian peaches,' found throughout the South and recognized by the downy and striped fruit and purple bark on the young growth, was introduced from Spain and gradually disseminated by the Indians. Apple-growing was quite extensively carried on by the Cherokee Indians in the mountain regions of Georgia, Alabama and North Carolina. The trees being all seedlings, as grafting was likely unknown to the Red Man, vestiges of old apple trees originally planted by these denizens of the South are still occasionally found in upper Georgia. Fifty years ago a large collection of apples was introduced into cultivation, and to-day many of the best southern winter apples owe their origin to the Indians, who procured the first seeds from traders."

1077. Earliest picture of an American plant. Monardes. 1571.

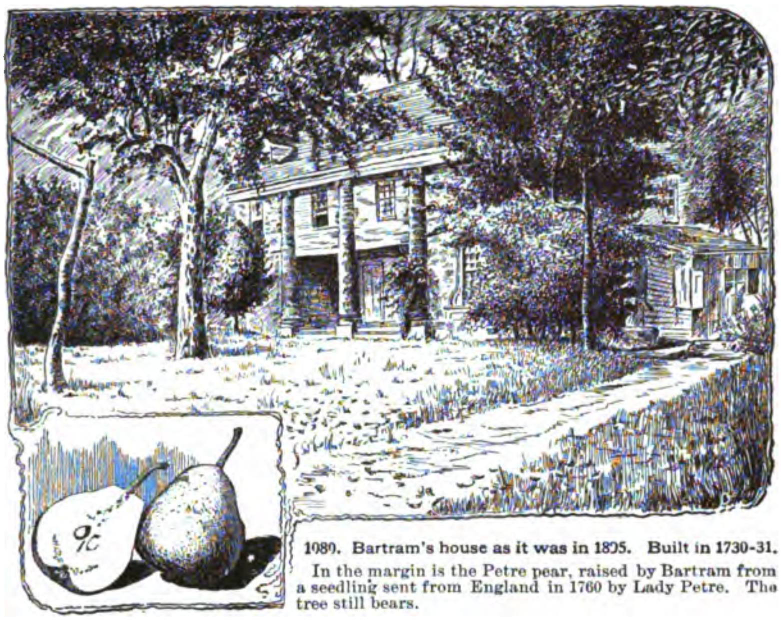
One of the earliest glimpses of plant-growing in the New World is an account in the Philosophical Transactions of the Royal Society, early in the eighteenth century, by Chief Justice Paul Dudley, of Roxbury, near Boston. In the Abridgement of the Transactions are the following notes, amongst others, under the date 1724: "The plants of England, as well those of the fields and orchards as of the garden, that have been brought over into New England, suit very well with the soil, and grow to perfection. The apples are as good as those of England, and look fairer, as well as the pears; but they have not all of the sorts. The peaches rather excel those of England, and there is no trouble or expence of walls for them; for the peach trees are all standards, and Mr. Dudley has had, in his own garden, 700 or 800 fine peaches of the rare-ripes, growing at a time on one tree. * * * The peach trees are large and fruitful, and commonly bear in 3 years from the stone. * * * The common cherries are not so good as the Kentish cherries of England; and they have no dukes, or heart-cherries, unless in two or three gardens." It was reported that people of "late years have run much upon orchards." The product of these orchards was chiefly cider. "Some of their apple trees will make 6, some have made 7 barrels of cider: but this is not common; and the apples will yield from 7 to 9 bushels for a barrel of cider: a good apple tree will measure from 6 to 10 feet in girt." Dudley mentions a bloomless apple, and "the tree was no graft." In common with other new countries, New England astonished persons with the luxuriant growth of the plants. "An onion, set out for seed, will rise to 4 feet 9 inches in height. A parsnip will reach to 8 feet; red orrice [orach] will mount 9 feet; white orrice 8. In the pastures he measured seed mullen 9 feet 2 inches in height, and one of the common thistles above 8 feet." Record is made of a pumpkin vine which grew unattended in a pasture. It made a single stem which "ran along over several fences, and spread over a large piece of ground far and wide." "From this single vine were gathered 260 pumpkins; one with another as large as a half peck; enough in the whole, to fill a large tumbrel, besides a considerable number of small and unripe pumpkins." Indian corn was "the most prolific grain." Mr. Dudley did not accept the notion that the mixing of corn is due to the intermingling of the roots, but thought that it was brought about through the agency of the wind. He also noted that the hop and the running kidney bean twine in opposite directions on their support.

1078. Relic of colonial days—apple tree at 250 years.

The colonial ornamental gardens were unlike our own in the relative poverty of plants, in the absence of the landscape arrangement, in the rarity of greenhouses, and the lack of smooth-shaven lawns (for the lawn mower was not invented till this century). These gardens were of two general types: the unconventional personal garden, without form but not void (Fig. 1079), in which things grew in delightful democracy; the conventional, box-bordered, geometrical garden, in which things grew in most respectful aristocracy. (Plate XIV.) There were many interesting and elaborate private gardens in the colonial days. One of the earliest and best was that of Governor Peter Stuyvesant, of New Amsterdam (New York, near Third Avenue), known as the "Bouwerie," where 40 or 50 negro slaves, and also white servants, were kept at work. "The road to the city had been put in good condition, and shade trees were planted on each side where it crossed the Governor's property." The Bowery of these degenerate days has lost the Eden-like features which distinguished its illustrious progenitor.

Excellent gardens were attached to the residences of wealthy persons by the middle of last century, and probably earlier, and they were said to have been encouraged by the example and precept of Washington. There are records of many large and meritorious collections of plants a century and more ago. William Hamilton's collection at Philadelphia was one of the best, and it contained a large collection of exotics. It flourished towards the close of last century, and was broken up in 1828. William Jackson began "a highly interesting collection of plants at his residence in Londongrove," Pennsylvania, in 1777. About 1800 Joshua and Samuel Pierce, East Marlborough, Pa., "began to adorn their premises by tasteful culture and planting," and by the establishment of an arboretum of evergreens. The most famous botanic garden which North America has ever had was John Bartram's, established at Philadelphia in 1728. It contained a great collection of native plants, and some of the trees are now amongst the most valued landmarks of the city. Bartram was a skilful farmer and gardener, and his sons, John and William, inherited his tastes and continued the garden. The elder Bartram was probably the first American to perform successful experiments in hybridization. Bartram's house (Fig. 1080), built by himself, is still one of the sights of the environs of Philadelphia, and the site of the garden, with many of the old trees standing, is now happily a public park. Bartram's cousin, Humphry Marshall, established a botanic garden at West Bradford, in Chester county, Pa., in 1773. John Bartram's name is preserved to us in the moss Bartramia, and Marshall's in the genus Marshallia, applied to small Compositæ of the eastern states. The Elgin botanic garden, near New York, was established in 1801 by David Hosack, a man of great learning and of the keenest sympathies with rural occupations. He

1079. An old-time garden.



1080. Bartram's house as it was in 1895. Built in 1730-31.

In the margin is the Petre pear, raised by Bartram from a seedling sent from England in 1760 by Lady Petre. The tree still bears.

is now remembered in the interesting genus Hosackia, one of the Leguminosæ. A botanic garden was established at Charleston, S. C., about 1804, and one in Maryland about the same time. The Botanic Garden at Cambridge, Mass., was begun in 1805, an institution which, together with the Professorship of Natural History at Cambridge, was founded largely through the efforts of the Massachusetts Society for Promoting Agriculture. The society subscribed $500 for the purpose, and raised more by subscription.

Early General Writings.—The progress of Horticulture may be traced in the books devoted to the subject. The earliest writings did not separate Horticulture from agriculture. The only work exclusively devoted to agricultural matters which appeared in America before the Revolution seems to have been the "Essays upon Field-Husbandry," begun in 1748 and completed in 1759, by Rev. Jared Eliot, of Killingworth, Conn., grandson of the famous apostle Eliot. (See *Eliot.*) "There are sundry books on husbandry wrote in England," said Eliot, in his preface. "Having read all on that subject I could obtain; yet such is the difference of climate and Method of Management between them and us, arising from Causes that must make them always differ, so that those Books are not very Useful to us. Besides this, the Terms of Art made use of are so unknown to us, that a great deal they Write is quite unintelligible to the generality of New-England Readers."

Just at the close of the Revolution, J. Hector St. John's "Letters from an American Farmer" appeared, although "the troubles that convulsed the American colonies had not broken out when * * * some of the * * * letters were written." For a period of twenty-five years following the close of the war the condition of our agriculture, and of all American institutions, was minutely unfolded to the world through the writings of many travelers, English and French, who made inquisitive journeys into the new country. Strickland, an English traveler, wrote in 1801 that "land in America affords little pleasure or profit, and appears in a progress of continually affording less. * * * Land in New York, formerly producing 20 bushels to the acre, now produces only 10. * * * Little profit can be found in the present mode of agriculture of this country, and I apprehend it to be a fact that it affords a bare subsistence. * * * Decline has pervaded all the states." There is abundant evidence, including a painstaking inquiry made by Washington, to show that agriculture was at a low state at the close of the century. It was in striking contrast to its status a hundred years later, notwithstanding the lugubrious writings of the present time.

There was early development of the garden desire in the South as well as in the North. In South Carolina appeared the earliest American horticultural book of which we have any record. This book is no longer extant, and it is known to this generation chiefly or wholly from the following page in Ramsay's "History of South Carolina," 1809: "The planters of Carolina have derived so great profits from the cultivation of rice, indigo (see *Indigo*) and cotton that they have always too much neglected the culture of gardens. The high price of their staple commodities in every period has tempted them to sacrifice convenience to crops of a marketable quality. There are numbers whose neglected gardens neither afford flowers to regale the senses, nor the vegetables necessary to the comfort of their families, though they annually receive considerable sums in money for their crops sent to market. To this there have been some illustrious exceptions of persons who cultivated gardens on a large scale, both for use and pleasure. The first that can be recollected is Mrs. Lamboll, who, before the middle of the eighteenth century, improved the southwest extremity of King street [Charleston], in a garden which was richly stored with flowers and other curiosities of nature, in addition to all the common vegetables for family use. She was followed by Mrs. Logan and Mrs. Hopton, who cultivated extensive gardens in Meeting, George and King streets, on lands now covered with houses. The former reduced the knowledge she had acquired by long experience and observation to a regular system, which was published after her death, with the title of 'The Gardener's Kalendar;' and to this day regulates the practice of gardens in and near Charlestown." Ramsay records that Mrs. Martha Logan was the daughter of Robert Daniel, one of the last proprietary governors of South Carolina. "Mrs. Logan was a great florist, and uncommonly fond of a garden. She was seventy years old when she wrote her treatise on gardening, and died in 1779, aged 77 years."

The opening of the nineteenth century may be taken as a convenient starting point for a narrative of the evolution of American Horticulture. At that time Horticulture began to attain some prominence as distinct from general agriculture, and the establishment of peace after the long and depleting war with England had turned the attention of the best citizens afresh to the occupation of the soil. The example of Washington, in returning to the farm after a long and honorable public career, no doubt exerted great influence. His agricultural correspondence was large, and much of it was published at the opening of the century. His correspondence with Arthur Young and Sir John Sinclair will be found in volumes published in London in 1800 and 1801, in Alexandria in 1803, and in Washington in 1847. Details respecting the management of his plantations comprise vol. iv. of the Memoirs of the Long Island Historical Society, 1889.

It was not until 1790, however, that an indigenous and distinctly agricultural treatise other than Eliot's appeared in America. At that time, the Rev. Samuel Deane, vice-president of Bowdoin College, published his "New England Farmer, or Georgical Dictionary," a cyclopedic work of the state of American agriculture. This passed to a second edition in 1797, and to a third in 1822. (See *Deane.*) In 1799 J. B. Bordley published in Philadelphia "Essays and Notes on Husbandry." Other early works need not be mentioned here. As early as 1785, Varlo's "New System of Husbandry" was printed in Philadelphia. It is in many ways a remarkable book, and it was written by a man who had had remarkable experiences. He was not an American, and the work first appeared in the old country; but Varlo had lived in this country, and was in sympathy with the American people. The book contained a "Farmer's and Kitchen Garden Calendar." In 1792 there appeared anonymously, from Burlington, New Jersey, the third edition of Arthur Young's "Rural Economy," which excellently displays that noted author's catholicity of view. He argues strongly for experiments and for the establishing of agricultural journals. This book first appeared in London, in 1770.

At the opening of the century, Sir Humphry Davy had not illumined the science of agricultural chemistry, and men were even disputing as to what the food of plants is. The "burn-baking" or "devonshiring" of the land—burning the sod and scattering the ashes over the field—was still recommended; and in 1799 James Anderson's "Essay on Quick-lime as a Cement and as a Manure," was given an American edition in Boston. It is easy to see from these facts that the fundamental conceptions of the science of agriculture were vague and crude a century ago. Near the close of the last century, Deane wrote that "the alarming effect of the present low state of husbandry is, that we are necessitated to import much of our food and clothing, while we are incapable of making proportionable remittances in the produce of the soil, or in anything else."

The earliest book on a horticultural subject known to have been published in North America, excepting Mrs. Logan's, was an American edition of Marshall's "Introduction to the Knowledge and Practice of Gardening," Boston, 1799. The first indigenous horticultural book appeared in 1804, "The American Gardener," by John Gardiner and David Hepburn. It was published at Washington. This book had an extensive sale. It was revised by "a citizen of Virginia," and republished in Georgetown, D. C., in 1818. A third edition appeared in 1826. (See *Hepburn*.) This book was followed in 1806 by Bernard M'Mahon's excellent and voluminous "American Gardener's Calendar," in Philadelphia. This work enjoyed much popularity, and the eleventh edition appeared as late as 1857. For fifty years it remained the best American work on general gardening. M'Mahon remembered in the Mahonia barberries, was an important personage. He was largely responsible for the introduction into cultivation of the plants collected by Lewis and Clark. These early books were calendars, giving advice for the successive months. They were made on the plan then popular in England, a plan which has such noteworthy precedent as the excellent "Kalendarium Hortense" of John Evelyn, which first appeared in 1664, and went to nine regular editions. Other early books of this type were "An old gardener's 'Practical American Gardener,'" Baltimore, 1819 and 1822; Thorburn's "Gentleman's and Gardener's Kalendar," New York, the third edition of which appeared in 1821; Robert Squibb's "Gardener's Calendar for the States of North-Carolina, South-Carolina, and Georgia," Charleston, 1827.

The first indigenous book written on the topical plan, treating subject by subject, was Coxe's fruit book, 1817; the second appears to have been Cobbett's "American Gardener," published at New York in 1819, in London in 1821, and which passed through subsequent editions. This William Cobbett is the one who edited the federalist paper in Philadelphia known as "Peter Porcupine's Gazette," and whose attack upon Dr. Rush's treatment of yellow fever brought against him a judgment for damages, and which decided him to return to England in 1800, whence he had come, by way of France, in 1792. In London he again took up political writing, and in 1817 he retreated to America to escape political penalties, and resided upon a farm on Long Island until 1819. He kept a seed store in New York in 1818, and we find Grant Thorburn disputing with him in the "Evening Post" as to which sold the better rutabaga seed at one dollar a pound. Cobbett, it seems, claimed to have been the introducer of this vegetable, also known as the Russia turnip, into this country; but Thorburn retorts that "in the year 1796 a large field of these turnips was raised by Wm. Prout on that piece of ground now occupied by the navy yard, at the city of Washington." He completed his life in England, becoming a voluminous author upon political and economical subjects. (See *Cobbett*.) It is interesting to note, in connection with this dispute about the turnips, that the kohlrabi was introduced about the same time, and Deane says of it in 1797, that "whether this plant, which has but newly found its way into our country, is hardy enough to bear the frost of our winters, I suppose is yet to be proved." It was recommended to be grown as a biennial, which accounts for Deane's fear that it might not pass the winters.

1061. Two old-time flowers—Hollyhock and Crown Imperial.

Fessenden's "New American Gardener," made upon the topical plan, appeared in Boston in 1828, and went to various editions; and from this time on, gardening books were frequent. Some of the leading early authors are Thomas Bridgeman, of New York; Robert Buist, of Philadelphia, and Joseph Breck, of Boston.

Flower-Books and Floriculture.—The first American book devoted wholly to flowers was probably Roland Green's "Treatise on the Cultivation of Flowers," Boston, 1828. Edward Sayers published the "American Flower Garden Companion," in Boston, in 1838. From 1830 to 1860 there appeared many of those superficial and fashionable books, which deal with the language of flowers, and which assume that the proper way to popularize botany is by means of manufactured sentiment.

Green's book on flowers deserves a paragraph, since it enables us to determine what were the leading ornamental plants in that early day (1828). The full title of the book is "A Treatise on the Cultivation of Ornamental Flowers; Comprising Remarks on the Requisite Soil, Sowing, Transplanting, and General Management: with Directions for the General Treatment of Bulbous Flower Roots, Greenhouse Plants, etc." It comprises only 60 pages. The introductory pages give general directions; then follow two annotated lists, one of annuals and biennials and the other of greenhouse plants. These lists are interesting, also, for what they do not contain. All the plants which they mention are here set down:

ANNUAL AND BIENNIAL FLOWERS.

Althæa frutex,
Almond, Double-flowering,
Amaranthus superbus,
Amaranthus tricolor,
Animated Oats,
Aster, China,
Auricula,
Azalea nudiflora,
Box,
Brier, Sweet,
Canterbury Bell,
Carnation,
Cassia Marylandica,
Catalpa,
Cherry, Double-flowering,
Chrysanthemum Indicum,
Clematis, Austrian (*C. integrifolia*),
Clethra,
Columbine,
Convolvulus,
Corchorus Japonicus,
Crocus,
Cupid's Car, or Monk's Hood (*Aconitum*),
Dahlia,

ANNUAL AND BIENNIAL FLOWERS—*Continued.*

Daisy,
Dwarf Basil,
Egg Plant,
Eupatorium, Blue,
Euphorbia Lathyris,
Fading Beauty, or Morning Bride (*Scabiosa*),
Fir (*Pinus balsamea*),
Foxglove,
Fringe Tree,
Geranium (*Pelargonium*),
Garden Angelica,
Glycine, Cluster-flowering,
Golden Coreopsis,
Golden Everlasting (*Xeranthemum*),
Hollyhock,
Honeysuckle,
Hyacinth,
Hydrangea,
Ice Plant,
Impatiens Balsamina,
Iris,
Lagerstrœmia Indica,
Laurel, Broad-leaved (*Kalmia*),
Laburnum,
Larkspur,
Lilac,
Lily,
Lime Plant (*Podophyllum peltatum*),
Lychnadia (*Phlox*),
Mezereon (*Daphne Mezereum*),
Mountain Ash,
Musk Geranium,
Myrtle,
Narcissus,
Nasturtium,
Passion Flower,
Pæony,
Pea, Sweet,
Peach, Double-flowering,
Pink,
Perennial Sunflower, double,
Polyanthus,
Pyrethrum Parthenium,
Poppy,
Purple Hyacinth Bean,
Roses,
Rose Acacia,
Rose colored Hibiscus,
Rudbeckia,
Scarlet Cacalia,
Scarlet Lychnis (*L. Chalcedonica*).
Siberian Crab,
Snow-ball Tree,
Snowberry,
Spice-wood (*Laurus Benzoin*),
Spiderwort (*Tradescantia*),
Spiræa,
Syringa, or Mock Orange,
Strawberry Tree (*Euonymus*),
Sweet Bay (*Laurus nobilis*),
Sweet William, or Poetic Pink,
Tulip,
Venetian Sumac, or Fringe Tree,
Violet, blue fragrant.

GREENHOUSE PLANTS.

Lilies of the valley,
Ranunculuses,
Anemones,
Single and Double Jonquils,
White Lilies,
Roses,
Tuberoses,
Persian Iris,
Mignonette,
Verbena trifoliata, or Sweet Vervain,
Fuchsia coccinea,
Cobæa scandens,
Camellia Japonica, or Japanese Rose,
Myrtles.

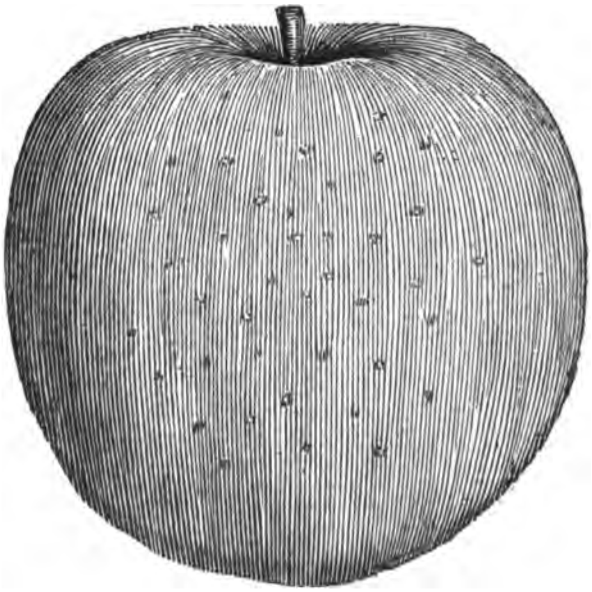
These lists are much less ample than those of M'Mahon, over twenty years earlier, but they may be supposed to include the popular and most easily grown things. They will be suggestive to those who wish to make "old-fashioned gardens." M'Mahon's list was evidently largely compiled from European sources. Green says that the first list (strangely called "annual and biennial flowers") contains "such plants, shrubs and trees as are of easy cultivation, generally hardy." The second list comprises "a few different sorts of greenhouse plants" "which are commonly grown in rooms."

The first American book to be devoted to a special flower was Sayers' book on the dahlia, Boston, 1839, which appeared only a year later than Paxton's well-known book in England. Sayers' book also included the cactus. The next special flower book seems to have been Buists' "Rose Manual," Philadelphia, 1844, although a sentimental book on the "Queen of Flowers" had appeared in the same city in 1841. Buist's book went to at least four editions. It was followed by Prince's in 1846, and by S. B. Parson's "The Rose: Its History, Poetry, Culture and Classification," 1846. Parson's book went to a revised edition. Of later-date flower-books there are several of importance, but it is not the purpose of this history to trace more than the beginnings of American floricultural writings.

In 1838 appeared a book in French in New Orleans. This was Lelievre's "Nouveau Jardinier de la Louisiane." It was a small book of 200 pages, with a calendar and brief directions for the growing of vegetables, fruits and flowers. Singularly enough, a French book also appeared at the other extreme of the country. This was Provancher's "Le Verger-Canadien," published in Quebec in 1872.

The writings clearly portray the tendencies of the floricultural interests,—from the formal-flower ideals of the dahlia and camellia to the enormous development of the cut-flower interest, and the growth within the last few years of the greater love of plants themselves. Palms and decorative plants are now almost necessities, where 50 years ago they would have been the luxury of luxuries. "There has been a radical change in the character of the flowers used for cut-flower purposes," wrote Alfred Henderson in 1895. "Fifty years ago, camellia flowers retailed freely for a dollar each, and during the holidays Philadelphia used to send thousands to New York florists, getting $500 per 1,000; while roses went begging at one-tenth these figures. Now, the rose is queen, and the poor camellia finds none so poor to do her reverence. * * * * I confidently believe that the time is not far distant when we shall compete seriously with the foreign grower in the production of new varieties of roses." William Scott, of Buffalo, makes the following comments on tendencies in floriculture: "About the year 1880, tulips and narcissuses began to be forced, and during the next 15 years immense quantities of these bulbs were imported annually from Holland. As the methods of forcing were perfected the market became overstocked, and, although large quantities are still forced for the winter and spring months, they are not now in the same favor as formerly, and the rose, carnation, violet, lily-of-the-valley and mignonette are still the favorites. Orchids are not yet the flower for the million, but there is a yearly increasing demand for them, and at present the showy orchids, such as the Cattleyas and Lælias, are far short of the demand. As their cultivation is more generally understood, we look for a very steady increase in the number grown, and are confident that the supply will not soon exceed the demand. Within the past 5 or 6 years a marked increase is noticeable in the use of plants to adorn the home, and the demand is for an expensive class of plants,—palms, dracenas, araucarias and ferns being among those mostly used. Now few homes with any pretension to luxury or even comfort are without a few fine plants scattered through the rooms, and many of our modern houses are provided with either a bay window or small conservatory for the accommodation of plants." See *Cut-Flowers* and *Floriculture*.

Early Pomological Writings.—It is in the pomological writings that North America has made the greatest contributions to horticultural literature. William Forsyth's excellent "Treatise on the Culture and Management of Fruit Trees" appeared in London in 1802, and it was widely read, "an impression of 1,500 copies (of the



1082. Example of the earliest illustrations of American fruits. Esopus Spitzenburg, figured by Coxe in 1817.

1083. One of the old Downing test apple trees.

first edition), in 4to having been sold in a little more than eight months." An American edition, by William Cobbett, appeared in New York and Philadelphia in 1802, and in Albany in 1803, and an epitome of it by "an American farmer," was published in Philadelphia in 1803. The first American pomological book was William Coxe's "View of the Cultivation of Fruit Trees," published in Philadelphia in 1817, a work known to students of horticultural literature for the uniform completeness and accuracy of its descriptions. A feature of this excellent work are the many woodcuts of varieties of fruits. Although not answering the requirements of the present day, they were considered to be very good for the time and for a new country. One of them is here reproduced (Fig. 1082) to show the style of workmanship. Coxe had 100 woodcuts of apples, 63 of pears, 15 of peaches, 17 of plums, 3 of apricots, 2 of nectarines. This makes 200 engravings, which would be considered liberal illustration even at the present day.

James Thacher's "American Orchardist" appeared in Boston in 1822, and the second edition at Plymouth in 1825. The first edition was also bound with William Cobbett's "Cottage Economy," and the double volume was issued in New York in 1824 as "American Orchardist and Cottage Economy." "The Pomological Manual," New York, 1831 (second edition 1832), is a compilation of descriptions of varieties, by William Robert Prince and William Prince, son and father respectively. William Kenrick's "New American Orchardist" was published in Boston in 1833. The eighth edition appeared in 1848. Like all early works, it devotes most of its space to varieties. Robert Manning, whose son of the same name is the secretary of the Massachusetts Horticultural Society, published his admirable "Book of Fruits," at Salem, in 1838, being aided by John M. Ives. Upon the death of Manning, Ives published a second edition in 1844 under the title of "The New England Fruit Book," and a third in 1847 as "The New England Book of Fruits." Downing's "Fruits and Fruit Trees of America" appeared in 1845 in two forms, duodecimo and octavo, although both issues were printed from the same type. One issue of the octavo form contained colored plates. Thomas' "Fruit Culturist," which is known in subsequent editions as "The American Fruit Culturist," appeared in 1846. Other pomological writings which appeared before 1850 are Sayers' "American Fruit Garden Companion," Boston, 1839; Hoffy's "Orchardist's Companion," Philadelphia, 1841; Bridgeman's "Fruit Cultivator's Manual," New York, 1845; Floy's American edition of George Lindley's "Guide to the Orchard and Fruit Garden," New York, 1846; Jaques' "Practical Treatise on the Management of Fruit Trees," Worcester, 1849; Goodrich's "Northern Fruit Culturist," Burlington, Vt., 1849; Cole's "American Fruit Book," and others. Barry's "Fruit Garden" appeared in 1851.

Of these pomological books, the first place should be given to those of Coxe, Kenrick, Manning, Downing, Thomas and Barry. The influence of Downing's "Fruits and Fruit Trees of America" probably has been greater than that of all others in extending a love of fruits and a critical attitude towards varieties. Begun by Andrew Jackson Downing—perhaps the fairest name in American horticultural literature—it was continued and revised by the elder brother, Charles, after the untimely death of the former (see *Downing*). Reminiscences of the Downings are shown in Figs. 1083-4. Most of these works were largely compilations. A notable exception was Manning's "Book of Fruits." In the introductory remarks to the volume is the following statement: "There is one circumstance to which we venture to call the attention of our readers—that while some recent works on pomology are compiled from earlier authors, or from information derived at second-hand, the writers themselves seldom having the means of observation in their power, we have in these pages described no specimen which we have not actually identified beyond a reasonable doubt of its genuineness." It was Manning who chiefly made known to Americans the pears of the Belgian, Van Mons. He was one of the most careful observers and conscientious writers amongst American pomologists.

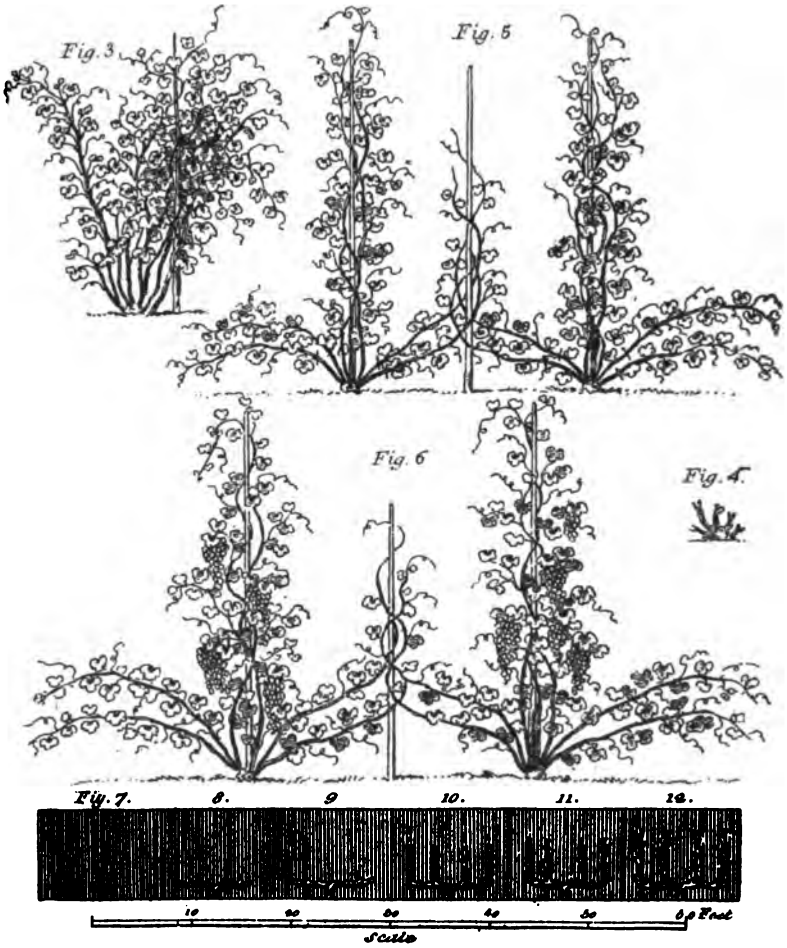
The awakening pomology of the region west of the Alleghanies found expression in Elliott's "Fruit Book," 1854, whose author wrote from Cleveland, and which went to a new edition in 1859 as "The Western Fruit Book," with the preface dated at St. Louis; and Hooper's "Western Fruit Book," 1857, written at Cincinnati. Dr. John A. Warder was a guiding spirit of the opening West.

In America, no crop has been the subject of so much book writing as the grape. Counting the various editions, no doubt a hundred books have appeared, being the work of at least fifty authors. Since the American grape is a product of our own woods within a century, the progress in grape-growing has always been ahead of the books. Most of the books are founded largely on European advice, and therefore are not applicable to American conditions. In general pomology, the books seem to have had much influence upon fruit-growing; but in the grape the books and actual commercial grape-growing seem to have had little relation one to the

1084. The fruit house of Charles Downing.

other. Some of the later books have more nearly caught the right point of view.

The earliest separate grape book was published in Washington in 1823, by the prophetic Adlum, "A Memoir on the Cultivation of the Vine in America." This went to a second edition in 1828 (see *Adlum* and Plate II). Before this time (1806), S. W. Johnson had devoted much space to the grape in his "Rural Economy," published at New Brunswick, N. J., and he published the first pictures of grape training (Fig. 1085). Adlum's book was followed in 1826 by the "American Vine Dresser's Guide," by the unprophetic Dufour. This work also gave pictures of grape training, one of which is reproduced in Fig. 1086. The larger part of the grape literature appeared before the close of the Civil War, although the larger part of the development of the subject has taken place since that time.



1085. The earliest American picture of Grape training (1806).

General Remarks on Fruit-Growing.—Horticulture, in its commercial aspects, was nothing more than an incidental feature of farm management at the opening of the century. In fact, it is only in the present generation that the field cultivation of horticultural crops has come to assume any general importance in the rural economy of the nation. And even now, horticultural operations which are projected as a fundamental conception of land occupation are confined to few parts of the country. It is still the original or first conception of the farmer's boy, when he proposes to occupy land of his own, that he raise grain and hay and stock, and add the fruits and other horticultural crops by piecemeal. It is only in particular parts of the country that the farmer starts out with Horticulture as a base, and with grain and stock and hay as accessories; and even in these places, the best horticulturists are still drawing their practices and the reasons for them from the operations of general mixed agriculture. There was practically only one general horticultural commodity, at least in the northern states, a hundred years ago, and that was the apple. Pears, peaches, cherries, quinces and some other fruits were common, but there was little thought of marketing them. Even the apple was generally an accidental crop. Little care was given the trees, and the varieties were few, and they were rarely selected with reference to particular uses, beyond their adaptability to cider and the home consumption.

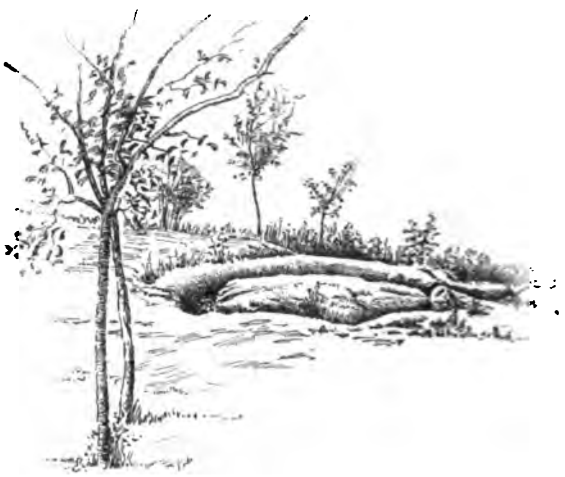
Thacher, writing from Plymouth in 1821, says that "the most palpable neglect prevails in respect of proper pruning, cleaning, and manuring round the roots of trees, and of perpetuating choice fruits, by engrafting from it on other stocks. Old orchards are, in general, in a state of rapid decay; and it is not uncommon to see valuable and thrifty trees exposed to the depredations of cattle and sheep, and their foliage annoyed by caterpillars and other destructive insects. In fact, we know of no branch of agriculture so unaccountably and so culpably disregarded." Were it not for the date of Thacher's writing, we should mistake this picture for one drawn at the present day.

If one may judge from the frequent and particular references to cider in the old accounts, it does not seem too much to say that this sprightly commodity was held in greater estimation by our ancestors than by ourselves. In fact, the cider barrel seems to have been the chief and proper end of the apple. Of his thirty chapters on fruit-growing, Coxe (1817) devotes nine to cider, or 42 pages out of 253. John Taylor's single epistle devoted to horticultural matters in the sixty and more letters of his "Arator" is upon "Orchards," but it is mostly a vehement plea for more cider. "Good cider," he says, "would be a national saving of wealth, by expelling foreign liquors; and of life, by expelling the use of ardent spirits." In Virginia, in Taylor's day, apples were "the only species of orchards, at a distance from cities, capable of producing sufficient profit and comfort to become a considerable object to a farmer. Distilling from fruit is precarious, troublesome, trifling and out of his province. But the apple will furnish some food for hogs, a luxury for his family in winter, and a healthy liquor for himself and his laborers all the year. Independent of any surplus of cider he may spare, it is an object of solid profit and easy acquisition." As early as 1647, twenty butts of cider were made in Virginia by one person, Richard Bennet. Paul Dudley writes of a small town near Boston, containing about forty families, which made nearly 3,000 barrels of cider in the year 1721; and another New England town of 200 families, which supplied itself with "near ten Thousand Barrels." Bartram's Cider Mill, as it exists at the present day, is shown in Fig. 1087. It was not until well into the present century that people seem to have escaped the European notion that fruit is to be drunk.

There are evidences that there have been several marked alternations of fervor and neglect in the planting of apples since the first settlement of the country. Early in the last century there appears to have been a great abundance of the fruit; but in 1821 Thacher declared that "it is a remarkable fact that the first planters bequeathed to their posterity a greater number of orchards, in proportion to their population, than are now to be found in the old colony," and he attributes the decline in orcharding largely to the encroachment of the "poisonous liquor" of the later times. Under the inspiration of Thacher, Coxe, Kenrick, Prince, Manning, and the Downings, orchards were again planted, and we are just now in another period of decline in the East, following the decay of these plantations.

Apples were carried far into the frontiers by the Indians and probably also by the French missionaries, and the "Indian apple orchards" are still known in many localities even east of the Mississippi (see also, *Appleseed, Johnny*). At the opening of the century, the Early Harvest, Newtown Pippin, Swaar, Spitzenberg, Rhode Island Greening, Yellow Bellefleur, Roxbury Russet, and other familiar apples of American origin were widely disseminated and much esteemed. Apples had begun to be planted by settlers in Ohio before 1800. In 1817, Coxe could recommend a list of "one hundred kinds of the most estimable apples cultivated in our country;" and in 1825 William Prince offered 116 varieties for sale—at 37½ cents per tree—of which 17 were set aside—after the fashion of the time—as particularly adapted to the making of cider. Of these 116 varieties, 61 were considered to be of American origin. In 1872, Downing's list of apples which had been fruited and described in America, had swelled to 1856 varieties, of which 1099 were of known American origin. Of this great inventory, probably not over a third were actually in cultivation at any one time, and very many of them are now lost. Yet the apple is still our most important fruit, and 878 varieties were actually offered for sale by the nurserymen of North America in 1892.

There has been a most noticeable tendency towards the origination of varieties of apples in this country, and the consequent exclusion of varieties of European origin. As early as 1760, cions of American varieties were sent to England. Before the Revolution, apples were exported. The origination of indigenous varieties was of course, an accidental one, and was a necessary result of the universal method of growing apple trees directly from seeds, and top-grafting them in case they should turn out profitless. A critical study of American Horticulture will show that all species of plants which have been widely cultivated in this country have gradually run into indigenous varieties, and the whole body of our domesticated flora has undergone a progressive evolution and adaptation without our knowing it. By far the greater number of the apples of the older apple-growing regions of the country are indigenous varieties, and the same process is now operating in the Northwest, where the American seedlings of the Russian stock are proving to be more valuable than the original importations.



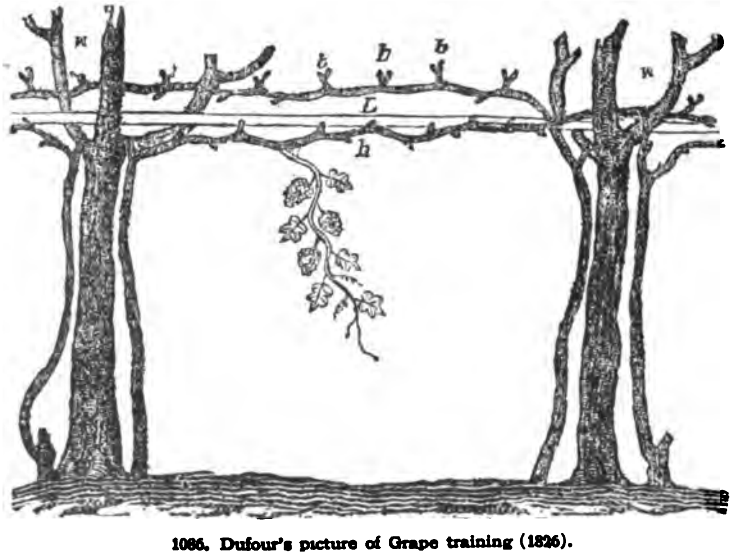
1087. Bartram's cider mill, a relic of the last century.

It is said that the apples were placed in the circular groove in the rock and crushed by means of a weight rolling over them. The juice ran out the gutter at the farther side and was caught in a rock-hewn cistern.

Pears were amongst the earliest fruits introduced into the New World, and the French, particularly, disseminated them far and wide along the waterways, as witnessed by the patriarchal trees of the Detroit river and portions of the Mississippi system. John Bartram's Petre pear (Fig. 1080) is one of the patriarchs of the last century, although the tree is not large. The first book devoted exclusively to the pear was Field's, published in 1859. The Japanese type of pears had been brought into the country from two and perhaps three separate introductions, early in the fifties, but they had not gained sufficient prominence to attract Field's attention. From this oriental stock has come a race of promising hybrids with the common pear, represented chiefly by the Kieffer, Le Conte and Garber.

Peaches were early introduced into the New World by various colonists, and they thrived so well that they soon became spontaneous Nuttall found them naturalized in the forests of Arkansas in 1819, and the species now grows with all the luxurious abandon of a native in waste and forest lands from Georgia and the Carolinas to the westward of the Mississippi. There is probably no country in the world in which peaches grow and bear so freely as in the United States. The old Spanish or Melocoton type is now the most popular race of peaches, giving rise to the Crawfords and their derivatives.

Of late years there has been a contraction of the original peach areas, and many good people have thought that the climate is growing uncongenial, but it is only the natural result of the civilization of the country and the change in methods of Horticulture. Peaches had never been an industry, but the orchards were planted here and there as very minor appendages to



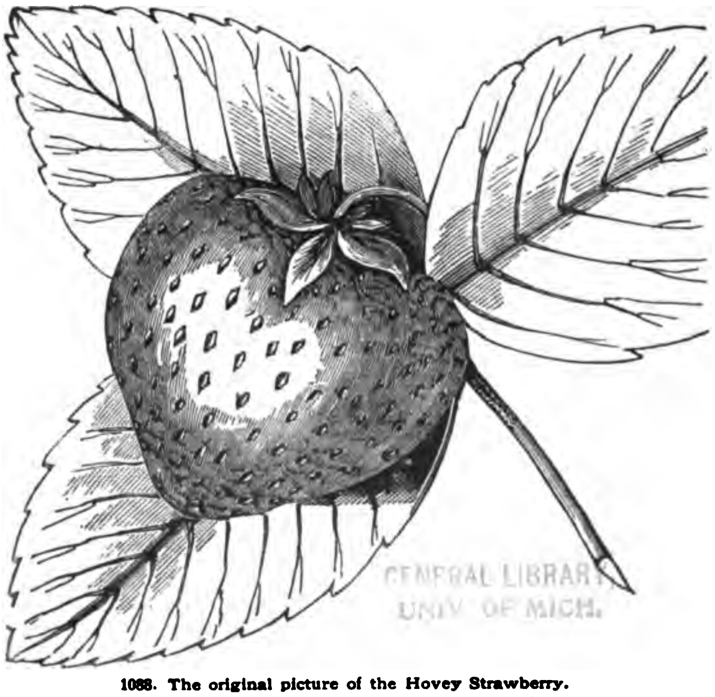
1086. Dufour's picture of Grape training (1826).

Patterned after the South-European fashion of employing mulberry trees for supports.

the general farming. For generations insect pests were not common. There were no good markets, and the fruit sold as low as 25 cents a bushel from the wagon box. In fact, it was grown more for the home supply than with an idea of shipping it to market. Under such conditions, it did not matter if half the crop was wormy, or if many trees failed and died each year. Such facts often passed almost unnoticed. The trees bore well, to be sure; but the crop was not measured in baskets and accounted for in dollars and cents, and under such conditions only the most productive trees left their impress upon the memory. The soils had not undergone such a long system of robbery then as now. When the old orchards wore out, there was no particular incentive to plant more, for there was little money in them. Often the young and energetic men had gone West, there to repeat the history perhaps, and the old people did not care to set orchards. And upon this contracting area, all the borers and other pests which had been bred in the many old orchards now concentrated their energies, until they have left scarcely enough trees in some localities upon which to perpetuate their kind. A new country or a new industry is generally free of serious attacks of those insects which follow the crop in older communities. But the foes come in unnoticed and for a time spread unmolested, when finally, perhaps almost suddenly, their number becomes so great that they threaten destruction, and the farmer looks on in amazement.

The orange is another tree which has thrived so well in the new country that the spontaneous thickets of Florida, known to be descendants of early Spanish introductions, are confidently believed by residents to be indigenous to the soil.

The progress of the plum in America nearly equals that of the grape in historic interest. The small, spontaneous plums, known as Damsons, the offspring of introductions from Europe, were early abundant in New England. Plum culture has never thrived far south of Mason and Dixon's line or west of Lake Michigan, except, of course, upon the Pacific coast and parts of the far southwestern country. There are climatic limitations which more or less restrict the area of plum growing, and the leaf-blight fungus, black-knot, and fruit-rot have added to the perplexities. In this great interior and southern area, various native plums, offshoots of several indigenous species, have now spread themselves, and they have already laid the foundation of a new type of plum culture. The first of these novel plums to receive a name was that which we now know as the Miner, and the seed from which it sprung was planted by William Dodd, an officer under General Jackson, in Knox county, Tennessee, in 1814. The second of these native plums to come into prominence, and the one which really marks the popularization of the fruit, is the Wild Goose. Some time before 1850, a man shot a wild goose near Columbia, Tennessee, and where the carcass was thrown this plum, Adonis-like, sprung forth. It was introduced to the trade about 1850, by the late J. S. Downer, of Fairview, Kentucky. Over 200 named varieties of these native plums are now described, and some of them are widely disseminated and deservedly popular. In the South and on the plains, these natives are a prominent horticultural group. The complexity of the cultivated plum flora is now further increased by the introduction of the Japanese or Chinese type, which first came in by way of California in 1870. Finally, about 1880, the apricot plum, or *Prunus Simonii*, was introduced from China by way of France; and the American plum industry, with no less than ten specific types to draw upon, and which represent the entire circuit of the northern hemisphere, is now fairly launched upon an experimental career whose promise lies with the coming century.


1088. The original picture of the Hovey Strawberry. Magazine of Horticulture, August, 1840. Original size.

GENERAL LIBRARY UNIV. OF MICH.

The grape of America is of two unlike types,—the natives, which comprise all commercial outdoor varieties in the interior and eastern states; and the vinifera or Old World kinds, which are grown in California. The native types have been developed within the century. The oldest commercial variety is the Catawba, which dates from 1802. The cosmopolitan variety, the Concord, which first fruited in 1849. A full review of the history is made in "Evolution of our Native Fruits."

There was no commercial strawberry culture in America, worthy of the name, until the introduction of the Hovey (Fig. 1088) late in the thirties. This and the Boston Pine were seedlings of C. M. Hovey's, Cambridge, Massachusetts. They first fruited in 1836 and 1837, and from them have descended most of the garden strawberries of the present day. These were seedlings of the old Pine type of strawberry, which is a direct descendant of the wild strawberry of Chile. The Wilson, or Wilson's Albany, which originated with John Wilson, of Albany, New York, began to attract attention about 1856 or 1857, and it marked the beginning of the modern epoch in American strawberry growing. In the middle West, strawberry growing was given a great impulse by Longworth and Warder.

Raspberries were grown in the last century, but they were of the tender European species, of which the Antwerps were the common types. This type of raspberry is now almost wholly superseded by the offspring of our native red and black species, which first began to impress themselves upon cultivation about 1860.

The blackberry, an indigenous American fruit, first commended itself to cultivation with the introduction of the New Rochelle or Lawton, towards the close of the fifties. The first named variety of blackbery of which we have any record was the Dorchester, which was exhibited before the Massachusetts Horticultural Society in 1841.

The dewberry, a peculiarly American fruit, first appeared in cultivation early in the seventies in southern Illinois under the name of the Bartel, which is a large form of the common wild dewberry of that region. It was first brought to the attention of the public in 1875. The following year the Lucretia, the most popular of dewberries, was introduced into Ohio from West Virginia, where it had been found wild some years before by a Union soldier.

The history of the gooseberry in America recalls that of the grape. It is a characteristic fruit of England and the low countries, and it was early introduced into America. But, like the European grapes, the gooseberries were attacked by a fungous sickness which rendered their cultivation precarious. An improved form of the native species must be introduced, and this was accomplished by Abel Houghton, of Massachusetts, who, from the seed of the wild berry, produced the variety which now bears his name. This variety began to attract some attention a little previous to 1850, although it was not planted freely until several years later (Fig. 1089). From seed of the Houghton sprung the Downing, still the most popular gooseberry in America, although Houghton is still much grown from Philadelphia south; and our gooseberry culture is, therefore, but two removes from nature. With the advent of the Bordeaux mixture and its related specifics, however, the English gooseberries are again coming to the fore. Hybrids of the English and American types, as in the Triumph or Columbia and the Chautauqua, may be expected to become more popular for home use and special markets, but the Americans will probably remain in favor for general market purposes.

1089. The original picture of the Houghton Gooseberry. From the Horticulturist for September, 1868. Original size.

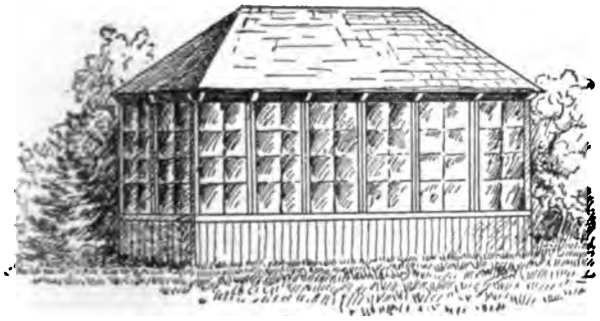
The cranberry, most unique of American horticultural products, was first cultivated, or rescued from mere wild bogs, about 1810. Its cultivation began to attract attention about 1840, although the difficulties connected with the growing of a new crop did not begin to clear away until about 1850. Cape Cod was the first cranberry-growing region, which was soon followed by New Jersey, and later by Wisconsin and other regions. The varieties now known are over a hundred, and the annual product from tame bogs in the United States is nearly 800,000 bushels.

THE NURSERY AND SEED BUSINESS.—It is impossible to fix a date for the beginning of the nursery business in America. Trees were at first grown in small quantities as a mere adjunct to general farm operations. Governor John Endicott, of the Massachusetts Colony, was one of the best fruit growers of his time, and he grew many trees. In 1644, he wrote to John Winthrop as follows: "My children burnt mee at least 500 trees this Spring by setting the ground on fire neere them;" and in 1648 he traded 500 apple trees, 3 years old, for 250 acres of land. The first nursery in Maine is thought by Manning to have been that of Ephraim Goodale, at Orrington, established early in the present century. Other early nurserymen of Maine were the brothers Benjamin and Charles Vaughan, Englishmen, who settled at Hallowell in 1796. The first nursery in South Carolina was established by John Watson, formerly gardener to Henry Laurens, before the Revolution. In Massachusetts, there were several small nurserymen towards the close of last century, amongst others, John Kenrick, of Newtown, whose son William wrote the "New American Orchardist," published in 1833, and which passed through at least eight editions. The trees were generally top-grafted or budded, sometimes in the nursery and sometimes after removal to the orchard. Deane writes in 1797, that "the fruit trees should be allowed to grow to the height of 5 or 6 feet before they are budded or grafted." Stocks were sometimes grafted at the crown, and even root-grafting was known, although it is generally said that this operation originated with Thomas Andrew Knight, in 1811. It is probable, however, that the root-grafting of last century was only grafting at the surface of the ground, and that it had little similarity to the method now in vogue. One of the new trees a hundred years ago was the Lombardy poplar. John Kenrick had two acres devoted to it in 1797; and Deane writes, in 1797, that "the Lombardy poplar begins to be planted in this country. To what size they will arrive, and how durable they will be in this country, time will discover." He does not mention it in the first edition, 1790. The tree is said to have been introduced into America by William Hamilton, of Philadelphia, in 1784, although Mr. Meehan writes that he remembers trees fifty years ago that seemed to be a century old. Manning quotes a bill of sale of nursery stock in 1799, showing that the price of fruit trees was 33⅓ cents each. With relatively cheaper money and with much better trees, we now buy for one-third this price. Deane speaks of raising apple trees as follows: "The way to propagate them is by sowing the pomace from cydermills, digging, or hoeing it into the earth in autumn. The young plants will be up in the following spring; and the next autumn, they should be transplanted from the seed bed into the nursery, in rows from 2 to 3 feet apart and 1 foot in the rows, where the ground has been fitted to receive them." Nothing is said about grafting the trees in the nursery.

But the first independent nursery in the New World, in the sense in which we now understand the term, seems to have been that established by William Prince at Flushing, Long Island, and which was continued under four generations of the same family. The founder was William Prince. The second Prince was also William, the son, and author of the first professed American treatise upon Horticulture, 1828. The third generation was William Robert Prince. He was the author of "A Treatise on the Vine" (1830), "The Pomological Manual" (1831), and "Manual of Roses" (1846). In the first two he was aided by his father, the second William. This William Robert Prince is the one who first distinguished the types of the prairie strawberry into the two species, *Fragaria Illinoensis* and *F. Iowensis*. From a large catalogue of William Prince second, published in 1825—and which contains, amongst other things, lists of 116 kinds of apples, 10 of pears, 54 of cherries, 50 of plums, 16 of apricots, 74 of peaches and 255 of geraniums—the following account is taken of the founding of this interesting establishment: "The Linnæan Garden was commenced about the middle of the last century by William Prince, the father of the present proprietor, at a time when there were few or no establishments of the kind in this country. It originated from his rearing a few trees to ornament his own grounds; but finding, after the first efforts had been attended with success, that he could devote a portion of his lands more lucratively to their cultivation for sale than to other purposes, he commenced their culture more extensively, and shortly after published a catalogue, which, at that early period, contained several hundred species and varieties, and hence arose the first extensive fruit collection in America." The elder Prince died in 1802, "at an advanced age."

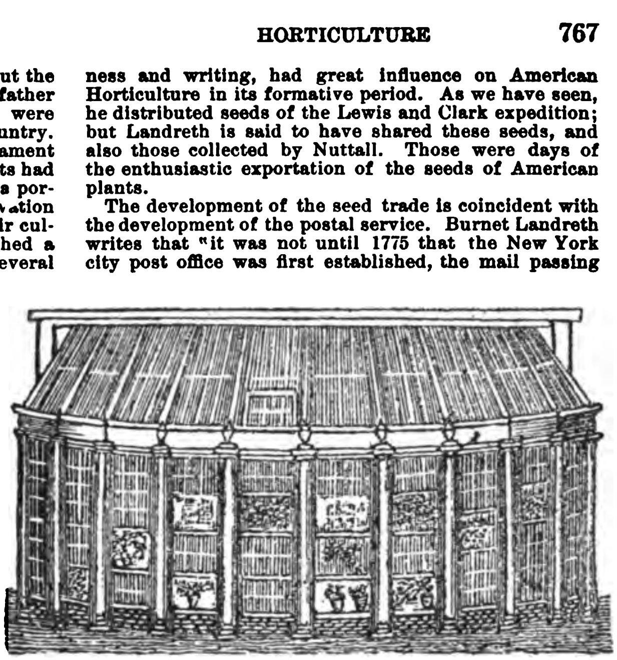
Amongst the nurseries which were prominent from 1820 to 1830 were Bloodgood's, Wilson's, Parmentier's, and Hogg's, near New York; Buel and Wilson's, at Albany; Sinclair and Moore's, at Baltimore. David Thomas, a man of great character, and possessed of scientific attainments, was the earliest horticulturist of central or western New York. His collection of fruits at Aurora, upon Cayuga Lake, was begun about 1830. His son, John J. Thomas, nurseryman and author of the "American Fruit Culturist," which first appeared in 1846, died at a ripe old age in 1895, and in his removal the country lost one of its most expert, systematic and conscientious pomologists. The nursery firm of Parsons & Co., on Long Island, was founded in 1838, and is continuing. It was instrumental in distributing great quantities of fruit and ornamental stock at a formative time in American Horticulture, and it was a pioneer in several commercial methods of propagation of the more difficult ornamental stock. It was the chief distributor of Japanese plants in the early days. Between 1840 and 1850 arose the beginnings of that marvelous network of nurseries, which, under the lead of Ellwanger & Barry, T. C. Maxwell & Brothers, W. & T. Smith, and others, has spread the name of western New York throughout North America. In 1857, Prosper J. Berckmans, who had then been a resident of the United States seven years, removed to Georgia, and laid the foundation of what is now the best known nursery in the South.

The first American seed house, David Landreth's, in Philadelphia, was established in 1784. The second was John Mackejohn's, 1792; third, William Leeson, 1794; fourth, Bernard M'Mahon, 1800, all of Philadelphia. In 1802, Grant Thorburn's was established in New York. The first and last of these businesses still exist under the family names. M'Mahon did a large business in exporting seeds of native plants, and it was through his work that many American plants came into cultivation in Europe. His catalogue of seeds of American plants in 1804, for the export trade, contained about 1,000 species of trees, herbs and shrubs. He also announced at that time that he had "also for sale an extensive variety of Asiatic, South Sea Islands, African and European seeds of the most curious and rare kinds." "The prices shall be moderate, and due allowance will be made to those who buy to sell again." M'Mahon, through business and writing, had great influence on American Horticulture in its formative period. As we have seen, he distributed seeds of the Lewis and Clark expedition; but Landreth is said to have shared these seeds, and also those collected by Nuttall. Those were days of the enthusiastic exportation of the seeds of American plants.



1090. One of the earliest American greenhouses. 1764.

The development of the seed trade is coincident with the development of the postal service. Burnet Landreth writes that "it was not until 1775 that the New York city post office was first established, the mail passing once every two weeks between New York and Boston. In 1775, a through mail was established by Postmaster Franklin between Boston and Savannah, the letters being carried by post riders, each man covering 25 miles. Previous to that date, sixty days would frequently pass without a mail from Virginia." Landreth estimates that there are now nearly two hundred seed firms in the United States publishing and distributing descriptive seed catalogues.



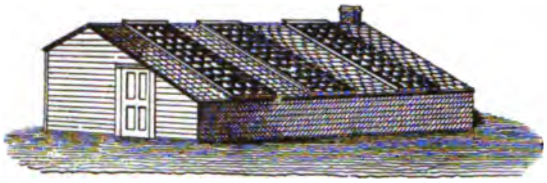
1091. Greenhouse front.

With glass lights and door of glass at the end, to be 7 feet high, 35 in length by 12 in breadth. Brick foundation 2 feet high, half a foot of which to be underground.—Robert Squibb, Gardener's Calendar, Charleston, S. C. 1827.

GREENHOUSES.—The first glasshouse in North America was probably that erected early in last century in Boston, by Andrew Faneuil, who died in 1737. This passed to his nephew, Peter Faneuil, who built Faneuil Hall. The greenhouse which is commonly considered to be the first one built in the country was erected in 1764 in New York, for James Beekman. A picture of this, from Taft's "Greenhouse Construction," is shown in Fig. 1090. Glasshouses were fully described in 1804 by Gardiner and Hepburn, and in 1806 by M'Mahon, but these authors do not state to what extent such structures existed in America. In Doctor Hosack's botanic garden, 1801, extensive glasshouses were erected. Compare Figs. 986, 987. Fig. 1091 shows one of the earliest American pictures of a greenhouse. It is copied, full size, from Squibb's "Gardener's Calendar," Charleston, S. C., 1827. Fig. 1092 shows the first greenhouse in Chicago, as illustrated in "American Florist." Note the small panes, and the sash construction. This was built in 1835 or 1836. With these pictures should be compared the modern greenhouses as shown in Fig. 1093; also in the pictures in the articles on *Greenhouse*.

These early houses were heated by flues or fermenting substances. The use of steam in closed circuits began in England about 1820. Hot-water circulation seems to have been a later invention, although it drove out steam heating, until the latter began to regain its supremacy in this country twenty or twenty-five years ago. The "New England Farmer" for June 1, 1831, contains a description of hot-water heating for hothouses, a matter which was then considered to be a great novelty.

Most of the early houses had very little, if any, glass in the roof, and the sides were high. It was once a fashion to build living rooms over the house, so that the roof would not freeze. In the "modern" construction of the greenhouse of M'Mahon's day, 1806, he advised that "one-third of the front side of the roof, for the whole length of the house, be formed of glass-work," and in order that the tall, perpendicular sides of the house should have as "much glass as possible," he said that "the piers between the sashes are commonly made of good timber, from 6 to 8 or 10 inches thick, according to their height." "The width of the windows for the glass sashes may be 5 or 6 feet; * * * the bottom sashes must reach within a foot or 18 inches of the floor of the house and their top reach within 8 or 10 inches of the ceiling. The panes in the roof should be 6 inches by 4, this size "being not only the strongest, but by much the cheapest, and they should lap over each other about half an inch." But the sides or "front lights must be made with large panes of glass." Many or most of the early plant-houses had removeable tops, made of sash. On the change from the old to the new ideas, Alfred Henderson writes as follows: "The first published advocacy of the fixed-roof system was made by Mr. Peter B. Mead, in the 'New York Horticulturist,' in 1857. Before that, all greenhouse structures for commercial purposes were formed of portable sashes, and nearly all were constructed as 'lean-to's,' with high back walls, and none were connected. All were separate and detached, being placed at all angles, without plan or system. Then, too, the heating was nearly all done by horizontal smoke-flues, or manure fermenting, although there was a crude attempt at heating by hot water by some private individuals as early as 1833. The first use of heating by hot water on anything like a large scale, however, was in 1839, when Hitchings & Co., of this city, heated a large conservatory for Mr. William Niblo, of New York; and yet for nearly twenty years after this time heating by hot water was almost exclusively confined to greenhouses and graperies on private places, as few professional florists in those days could afford to indulge in such luxuries. All this is changed now. The use of steam, hot water under pressure, and the gravity system of hot-water heating are almost universally in operation, the hot-air flue having been relegated to the past. The best evidence of progress is in the fact that the florist has not waited for the tradesman, but has brought about these improvements himself."


1092. First greenhouse in Chicago (1835 or 1836).

Much attention was early given to the slope of the roof, in order that the greatest amount of sunlight might be obtained. Early in this century the curvilinear roof came into use, as the various angles which it presents to the sun were supposed to catch the maximum number of the incident rays. The sides of the house remained high, for the most part, until near the middle of this century. All this shows that the early glasshouse was modeled after the dwelling or other buildings, and that it had not developed into a structure in which plants were grown for commercial purposes.

The modern commercial forcing-house, with direct roof, low sides, and heated by steam or hot water in closed circuits, is mostly a development of the last thirty years. Its forerunner was the propagating-pit of the nurseryman. If anything is lost in sunlight by adopting a simple roof, the loss is more than compensated by the lighter framework and larger glass. In the forcing-house, all architectural ambition is sacrificed to the one desire to create a commercial garden in the frosty months.

Lettuce, cucumbers, tomatoes, carnations, violets, and various other plants are now grown as crops under glass roofs, whilst a generation ago they were generally not forced at all for market or were grown mostly under frames. With the simplifying and cheapening of the glasshouse, amateur flower and vegetable growing has acquired a new impetus, and the business of the retail florist has grown amazingly in the recent years.

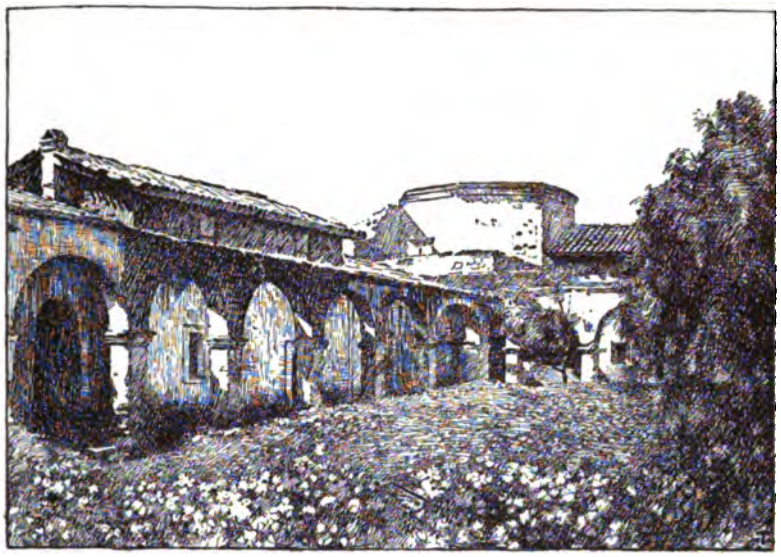
Some idea of the increase of the demand for plants may be obtained from the sale of flower pots. A. H. Hews, of Cambridge, Massachusetts, whose ancestors began the manufacture of pots before 1765, reports that for a period of twenty-two years, from 1788 to 1810 the accounts of the sales of pots "cover about as many pages as we now often use in one day; and the amount in dollars and cents does not compare with single sales of the year 1894." He also compared the sales for 1869 and 1894 and "found the increase as ten to one; or, in round numbers, 700,000 flower pots in the former year and 7,000,000 in the latter; and if the same factory can in 1920, twenty-five years later, produce and sell 70,000,000, we shall verily be living in a land of flowers."

One of the earliest greenhouse builders was Frederic A. Lord, who built his first houses, according to Taft, in Buffalo in 1855, and who, in 1872, entered into partnership with W. A. Burnham, at Irvington, on the Hudson. In very recent years a new impetus has been given to glasshouse building and work by the establishment of the agricultural experiment stations and the extension of horticultural teaching in the colleges.

HORTICULTURE IN CALIFORNIA.—California Horticulture is in the main patterned after the South-European types, and to this extent it originated from Spanish-Mexican sources. The Horticulture of California's high mountain valleys approximates more closely to that of colder regions, while the Horticulture of the Pacific slope, north of California, becomes more and more different from the South-European types, but still has many characteristics of its own separating it sharply from that of the Atlantic slope. The first horticultural experiments in California were at the missions of the Peninsula (Baja or Lower California), where 22 missions were founded between 1697 and 1797. Here the Mission Fathers introduced the date palm; also oranges, lemons, limes, pineapples, bananas, olives, figs, pomegranates, peaches, quinces, plums, apples, pears and grapes. They shipped to Monterey and the northern missions large quantities of dried figs, grapes, dates and peaches. The Upper California missions received seeds, cions, etc., from those of Lower California, as well as from Mexico. The first of these missions was established in 1769 at San Diego by the Franciscans, under the leadership of Father Junipero Serra, whose name visitors to the California State Building at the World's Fair will recall in connection with the great date palm from the Mission Valley of San Diego. This palm was raised from seed which Junipero Serra planted about 1770. Twenty-one missions were founded by the Franciscans, the last one in 1823, and at all but one or two of them there were important collections of the fruits of south-

1093. Interior of a modern commercial greenhouse—Carnations.

ern Europe—olives, figs, oranges, lemons, pomegranates, wine grapes, and also apples, pears and peaches. Early in this century the mission of San Gabriel had over 2,000 fruit trees, and others had more than a thousand. Fig. 1094 shows the yard of San Juan Capistrano Mission, as it existed in 1889. There are also some traces in California of the fruits of the few early Russian settlements. With the American occupation and the immigration from the East, came the eastern American types of fruits, and the state is now the seat of a wonderfully varied fruit culture, although the small fruits have not yet attained that prominence which they enjoy in older countries.



1094. One of the early California Missions, which were the early promoters of Horticulture on the western coast—San Juan Capistrano.

Details of the early Californian Horticulture are given for this occasion by Charles Howard Shinn. The first official horticultural reports from California appeared in the second part of the United States Patent Office Report for 1851. In this report, Mr. A. Williams, of San Francisco, presented statistics from the Horner Ranch, near the Mission San José, Alameda county, where 800 acres were planted in vegetables and the crop of 1851 sold for upwards of $200,000. The crop of potatoes, onions, beets, turnips and tomatoes was 134,200 bushels. The same report noted an onion weighing 21 pounds, and at the Fair of 1853 the committee on vegetables reported a "white flat turnip" weighing 33 pounds, a squash that weighed 121 pounds, and a tomato weighing 5⅙ pounds. Thus early California began to boast of the mammoth productions of her soil. The first official report printed in California appeared in a document issued by the Secretary of State for 1852. The capital then employed in "fruits and orchards" was given at $366,910. The market-garden interests were surprisingly large; among single items were "460,000 pumpkins, worth $46,000;" upwards of 5,000,000 pounds of onions, "worth $186,000;" 30,000 bushels of beans, "worth $72,000." Santa Barbara county reported "1,370 barrels of olives, worth $27,500." Horticultural statistics are continued in the reports of the state Surveyor General. In December, 1853, the State Agricultural Society of California was organized, after a successful exhibition in San Francisco, where almonds, figs, olives, walnuts, and many other fruits, as well as vegetables and flowers, were shown. Fairs were held in 1854 and 1855, but were not officially reported. The state began to publish the proceedings of the agricultural society in 1858, when its membership was 856, and annual reports have continued till the present time. The California Horticultural Society was organized April 5, 1881; in 1883, the State Board of Horticulture was established. Reports of these bodies and of the state fruit-growers' conventions have appeared annually or biennially since 1882. The State Viticultural Commission was organized in 1881, and its reports continued until 1894. Upwards of one hundred octavo volumes represent the official output of California since 1858 in lines of Horticulture, including, of course, the California Experiment Station reports.

Among the special California horticultural literature, are the following: "California Fruits," E. J. Wickson, first edition, 1889; second edition, 1891; third edition, 1900. So many changes and additions have occurred in this book that all three editions will be found very useful in libraries. "California Vegetables," E. J. Wickson, 1897. The only book on this subject that has yet appeared (1900). "Gardening in California," Wm. S. Lyon, Los Angeles, 1897. This is a small volume of 156 pages. "Olive Growing," Pohndorff, San Francisco, 1884. "Olive Culture," A. Flamant, San Francisco, 1887. "The Olive," Arthur T. Marvin, San Francisco, 1888. "The Raisin Industry," Gustav Eisen, San Francisco, 1890. "The Wine Press and Cellar," E. H. Rixford, San Francisco, 1883. "Grape Culture, a Handbook for California," T. Hart Hyatt, San Francisco, 1876. "Orange Culture in California," Thomas A. Garey, San Francisco, 1882. Contains appendix on grape culture, by L. J. Rose. "Orange Culture," W. A. Spalding, Los Angeles, Calif. "The California Farmer," established in January, 1854, and maintaining a spasmodic existence for a number of years, printed the first pomological and horticultural reports of committees, etc. "The Rural Press" was established in 1871, in San Francisco, and still continues. "The Rural Californian," of Los Angeles, still in existence, was established in 1877. "The California Fruit-Grower," commenced in 1888, and still survives (1900). "The California Florist," first issued in Santa Barbara, then in San Francisco, began in May, 1888, and stopped in April, 1889. "The California Cultivator," of Los Angeles, established in 1884, still published. "The Pacific Tree and Vine," of San José, established in 1882, still published.

California is now a horticultural wonderland; but its illimitable plantations are depressing to the man of small means and non-commercial ambitions, or to those who would grow for the discriminating personal market. Difficult climates develop the highest type of the amateur.

Periodicals.—Whilst the periodicals of any subject are supposed to chronicle all the fleeting events of the days and years, and to embalm them for future generations, it is the most difficult thing to remember and record the journals themselves. Many horticultural journals have lived and died in this country without having attracted the attention of a single library or collector of books. They germinated in the rich soil of expectation, bloomed in the dewy morning of enthusiasm, and collapsed when the sun rose. It is probably no exaggeration to say that 500 horticultural journals have been started in North America. There are about 40 in the flesh at the present moment. The "Massachusetts Agricultural Repository" was started in 1793, and this was the first agricultural journal in the country, but it was as late as 1821 that a horticultural department was added to it. The first journal to devote any important extent of its space to horticultural matters was the

that "one-third of t
whole length of the hou
and in order that
house should have
that "the piers b
of good timber, f

1092. I

to their
glass sa-
sashes
of the
the ce-
by 4.
much
about
be m
the
sash.
Alf-
lis-
M
in
n.

[illegible] was the "California Culturist," the first num[illegible] appeared in January, 1859. This ran through [illegible], and it records the marvels of the first [illegible] fruit-growing upon the Pacific slope. The [illegible] Horticulturist" was established in 1871, and [illegible] 10 yearly volumes, when, in 1880, it was [illegible] into the "Pacific Rural Press," which is still [illegible] existence. The current periodical literature [illegible] no comment here, except to remark that po[illegible]y—the one distinctive feature of American Horticulture—has no journal devoted to its interests.

America has never been favored with horticultural [illegible] to the extent to which England and other countries have. The first attempt of the kind seems to have [illegible] Woodward's "Record of Horticulture," edited by [illegible] Fuller, which appeared in 1866 and 1867. The next venture was the "American Horticulttural Annual," New [illegible], for the years 1868, 1869 and 1870, under the general editorial care of Dr. George Thurber. The attempt [illegible] not made again until the present writer established [illegible] Annals of Horticulture," in 1889, and which was issued [illegible] years, the last volume containing an account of [illegible] Horticulture of the Columbian Exposition.

HORTICULTURAL SOCIETIES.—The year 1785 saw the establishment of two agricultural societies, the Philadelphia Society for Promoting Agriculture, and the Agricultural Society of South Carolina. These were followed in 1792 by the organization of the Massachusetts Society for Promoting Agriculture. It was not until 1818, however, that the first horticultural organization came into existence, the New York Horticultural Society, now, unhappily, extinct. It expired about 1837. The second, organized in 1827, was the Pennsylvania Horticultural Society, which is still in vigorous existence. The third, according to Manning, was the Domestic Horticultural Society, organized at Geneva, New York, in 1828, and which was the forerunner of the Western New York Horticultural Society, the latter having continued for [illegible] years, and which now enjoys the most energetic and continental membership of any similar society in the [illegible]. The next organization was the Albany Horticultural Society, established in 1829, but which expired [illegible]. In 1829, also, the Massachusetts Horticultural Society was organized, an association which, in the character of the men who have been members of it and in the service which it has rendered to the advancement of [illegible] taste, stands without a rival in the country. The American Pomological Society was organized in [illegible] through a union of the North American Pomological Convention and the American Congress of Fruit-Growers, [illegible] of which were established in 1848. The [illegible] Fruit-Growers was a meeting held in New [illegible] of October, 1848, at the call of the [illegible], Philadelphia, New Jersey and New [illegible] Societies and the Board of Agriculture [illegible] American Institute of the City of New [illegible]. The Pomological Convention held its first meeting [illegible] September in Buffalo. The American [illegible] Society is undoubtedly the strongest organization [illegible] pomologists in the world. A. J. Downing [illegible] that "within the last ten years the taste [illegible] pursuits has astonishingly increased [illegible] States. There are, at the present moment, [illegible] societies in different parts of the [illegible] devoted to the improvement of gardening, and [illegible] dissemination of information on the subject." [illegible] present time there are over 500 such societies, [illegible] average attendance at the meetings cannot be [illegible] aggregate, than 15,000. From a careful esti[illegible] made in 1891, I concluded that the aggregate attendance for that year at the national, state, pro[illegible] district societies "probably exceeded 5,000." [illegible] now at least ten national societies devoted to [illegible] or some branch of it. The most gratifying [illegible] of this movement towards organization, however, [illegible] establishment of great numbers of local [illegible] clubs, and the like, which sustain the [illegible] horticultural pursuits and foster pride in [illegible] surroundings of the members. All this [illegible] of societies is proof enough that there is a [illegible] expanding and abiding love of Horticulture in America, and that it must increase with the increasing [illegible] of the country.

1095. A modern commercial apple orchard, in clean tillage.

Experiment Stations and Colleges. — Closely associated with the aims of the societies in the general extension of education, are the experiment stations and agricultural colleges. These institutions are the result of agitations in the agricultural societies. These agitations began over one hundred years ago. Most of the experiment stations are founded upon the Federal law known as the Hatch Act, which received the President's signature March 2, 1887. There are now 55 experiment stations in the United States. There are a dozen scientific bureaus and divisions connected with the Department of Agriculture at Washington, three of which directly concern the horticulturist: Divisions of Pomology, Vegetable Pathology and Entomology, and to these might be added the Division of Gardens and Grounds. The work of all these stations and of the agricultural bureaus and divisions is condensed and epitomized in the "Experiment Station Record," a monthly publication of the Department of Agriculture.

The writings and teachings of the horticulturists in the colleges and experiment stations will, in time, bring our horticultural activities into proper relationships and perspective. These men will arrive in time at judicial conclusions on the disputed points. It is only those persons who have some taste and leisure for study and reflection who can do this. Persons who are intensely absorbed in one commercial pursuit usually exalt that pursuit out of all proportion to its relative importance.

Commercial Transportation.—The rise of the great commercial movement in horticultural products may be said to have taken place since the civil war. The first important invention to usher in this era, aside from improvements in transportation, was that of canning perishable commodities. The method originated with a Frenchman in 1795, but it first became an assured and recognized success in this country. The inauguration of the process dates from 1825, when President Monroe signed patents to Thomas Kensett and Ezra Daggett, to protect them in an improvement in the art of preserving. Kensett appears to have canned various products somewhat extensively as early as 1819. At the present time. the United States outstrips other countries in the variety and extent of its canned goods. Over 20,000 factories in North America now employ towards a million hands, directly or indirectly. during the canning season. For a sketch of the development of the canning industry, see an article by Edward S. Judge in "One Hundred Years of American Commerce."

Drying fruit for market by fire heat began to attain some prominence about 1860, but the advent of the Alden drier about 1870, and the Williams and others at about the same time, brought in the modern "evaporated" product, which is now an inseparable adjunct of the fruit trade. In the East, the most important region of evaporating establishments is western New York, particularly Wayne county, although California far excels other areas in the output of similar products.

The exportation of fruit has lately assumed large proportions. The first record known to the writer of the shipping of fruit across the ocean occurs in the correspondence of John Bartram, from which it appears that as early as 1773 apples were shipped to England in "great quantities." In 1821, 68,643 bushels of apples were exported. The modern apple export trade is generally said to have begun with the shipment of five barrels from Boston to Glasgow in 1845 under the auspices of one Buchanan, a Scotchman. The first heavy exportations were made about 1880. In the season of 1880–81 the total shipment of apples from North America to Europe was 1,328,806 barrels. The subsequent heavy years of the earlier period were as follows: 1888–89, 1,407,409 barrels; 1891–92, 1,450,336 barrels; 1892–93, 1,203,538 barrels; 1894–5, 1,438,155 barrels. California green fruits were first shipped to Europe in 1891, but the first public shipments were made the following year. Fresh grapes from the East were first shipped in 1892 from Chautauqua county, New York. Florida first shipped oranges to Europe in the fall of 1892, and California early in 1893. The cranberry was first put upon the European market in 1893. The first shipment of fresh peaches across the ocean from the East appears to have been made in 1893, when a consignment of Delaware peaches was made to Ambassador Bayard at London, but the attempt was only partially successful. The Canadians have recently made careful experiments with transatlantic shipments. The annual value of fruit exports from the United States (including cider, vinegar, canned and preserved fruits, nuts, and all green fruits) is about five million dollars' worth. The largest single item in this aggregate is fresh apples, comprising one and one-third million dollars' worth.

Unfortunately, there are no statistics of American Horticulture. Various horticultural inquiries were included in the schedules of the Eleventh Census (1890); only a few bulletins of summaries were published. The American Cranberry Society makes a yearly summary of the output, by means of correspondence amongst its members. The apple exporters have records of the transatlantic apple trade. The Treasury Department publishes summary statistics of imports and exports. But beyond this, there is little statistical measure of our horticultural wealth, except figures which are gathered now and then for special areas from transportation companies. The Twelfth Census is giving attention to the matter.

A summary history of the fruit trade was written by John W. Nix for Depew's "One Hundred Years of American Commerce," 1895. "One hundred years ago the fruit merchant, as such, did not exist in this country. Some of the larger importers occasionally received, among the other articles of an assorted Mediterranean cargo, a few half casks of dried prunes, currants, raisins, or grapes, but beyond these even the luxurious did not aspire. It was some years before even so simple a custom as selling native fruit brought to town in season by the neighboring farmer became at all general with the old New York grocers." The first bananas were imported into the United States in 1804, but "it was not until 1830 and later that the importation of foreign fruit was considered seriously." "In 1832 there arrived at New York by sailing ship the first cargo of oranges from Sicily. Lemons followed almost immediately, and the Mediterranean fruit trade became a recognized interest from that time." The fruits came to be sold largely by auction. About 1865 the wholesale commission business had "come to be a generally recognized feature of the fruit trade, many of the Italian growers * * consigning their fruit directly to American firms." "About 1880, the third and last change in the methods governing the Italian fruit trade began with the establishment here of representatives of several of the large Italian houses." "Prior to the civil war and for several years afterward, the small fruits of New York, New Jersey, Long Island and Delaware were the only competitors of the foreign fruit. * * * Such was the condition of affairs in 1867, when the first consignment of green fruit from California was shipped by express to New York."

L. O. Thayer, editor of "Cold Storage," New York, estimates that there are in the United States (in 1900) 920 cold stores, excluding 300 used exclusively for meat. Of this 920 he says that 700 are fitted for the storing of fruits, produce, eggs, butter, etc. The capacity of these 700 is something like 35,000,000 cubic feet, or a yearly capacity of 980,000,000 pounds. He also says that there are about 220,000 refrigerator cars in use in this country; of this number about 50,000 are used for transportation of perishable products and the remainder for meats. Almost every cold store works to its fullest capacity at least nine months of the year. In Canada there are 40 cold stores, about 30 of them being fitted for butter, eggs and produce. Their capacity is about 200,000 cubic feet.

CONCLUSION.—The one most significant thing in American Horticulture is the fact that it is American. Ideals, methods, varieties, implements, are unique. Even the species of plants which we cultivate are often peculiar to ourselves. This is particularly true in the fruits, for the native wild species have given us our grapes, raspberries, blackberries, dewberries, mulberries, cranberries, some gooseberries, many plums, some apples, and various minor fruits. In other esculents, it has given us the pumpkins and squashes, Indian corn, beans and Jerusalem artichokes. Our native flora has enriched the flower gardens of our own country and of the world. An inquiry made in 1891 showed that 2,416 species of the United States and Canada had been introduced to cultivation. In that year, 1,929 of these species were actually in the trade, and 1,500 had been introduced into England. Even when the species are of Old World origin, the varieties are American in most of those types which have been long cultivated here. Very few Old World apples and peaches are popular in North America, and the number in pears, plums and other fruits is constantly decreasing. The American carnation is already of a different type from the European. One of the strongly American features of our Horticulture is the great proportionate development of the cut-flower industry; but the last few years have seen a relative increase of pot-plant and decorative-plant demands. These divergencies are likely to increase rather than diminish. The tendencies which differentiate our Horticulture from that of the Old World will also differentiate the Horticulture of each geographical area of our own country, thereby giving each area the varieties and the methods which are best adapted to it.

The second most significant thing in our Horticulture is its strong commercial trend. This is particularly true of fruit-growing and cut-flower-growing, which have developed on a large-area basis (Figs. 1093, 1095). The first horticultural interest in this country was the amateur or home-garden type. That type is not dead, and it will not die so long as hearts burn for the out-of-doors and souls long for beauty and for the solace of nearness to nature. Amateur or personal Horticulture is increasing with great rapidity. It is a part of the ripening of the home life and the acquiring of leisure. Personal gardening is intellectual employment. The amateurs are the chief buyers of horticultural books. Yet, for all this, the prevailing note in American Horticulture is commercialism, and this note is the stronger the farther one goes from the Atlantic seaboard. Both types of Horticulture will increase. They are not incompatible, but complementary. Both are necessary to the greatest public weal. The commercial type will always be the aspiration of the comparatively few: it is coming more and more to be a profession. The personal or amateur type will be increasingly the hope of the many, for every person who has a home wants a garden.

Another important feature of our Horticulture is its living literature. Persons may care nothing for books; yet the literature of any subject is the measure of its ideals. Persons may say that the books are theoretical and beyond them; yet good books are always beyond, else they are not good. There is no use for literature if it does not inspire and point to better things. We measure the aspirations of any time by its writings. Whether the fact be recognized or not, the literature of our Horticulture is an underlying force which slowly dominates the thoughts and ideals of men. A book is a powerful teacher. It states its propositions, and is silent; and in the silence its lessons sink into the fiber of the mind. More than 600 books have enriched American Horticulture. Many of them have been poor, but even these may have challenged controversy and have done good. The early books were largely empirical and dogmatic. Downing, for example, in 1845, says that tillage makes better orchards, and he cites cases; but he does not give reasons. He does not mention nitrogen, potash, soil moisture, chemical activities. He does not even mention plant-food in connection with tillage. The horizon has widened since then. Men do not take up things actively until they know the reasons. The poor farmer, not knowing reasons for anything, has no inspiration and goes fishing. Thirty years ago, Colonel Waring was the apostle of deep-plowing; yet one should plow neither deep nor shallow until he knows why. Our literature has been singularly devoid of principles and analysis. The great writer is he who catches the significant movements and ideas of his time and portrays them to inspire his reader. Henderson first caught the rising commercial spirit of our vegetable gardening; his "Gardening for Profit" is the greatest American vegetable gardening book, even if somewhat out of date as a book of practice. The book of principles is now needed by the vegetable-gardener. American pomology has several strong names amongst its writers. Most of these writers have sacrificed fundamental things to varieties. The first sustained effort to write on fruit-growing from the point of view of underlying principles was by Charles R. Baker, who in 1866 published his "Practical and Scientific Fruit Culture." But the time was apparently not yet ready for a book of this kind, and much of the discussion lacked vital connection with the orchard. The book was too suggestive of the study and the compiler. Coxe, Kenrick, Manning, Downing, Thomas, Warder, Barry, Fuller, are significant names in American pomological literature. In floriculture there have been many excellent treatises, but there is not a single great or comprehensive book. In recent years, the making of horticultural literature is passing more and more from the working horticulturist to the specially trained student and writer.

The great development of American Horticulture, as compared with European standards, has been in fruit-growing and its accessory manufactures, and cut-flowers. Its landscape planting is also a strong feature, and is increasing rapidly. Its cemetery planting is probably the best in the world. In America, also, the development of agricultural tools and appliances, and of spraying for insects and diseases, have reached their highest development. Other characteristic features of our Horticulture are its youth, and the vigor with which its scope is enlarging.

L. H. B.

HOSÁCKIA (David Hosack, professor of botany and medicine in New York; author of Hortus Elginensis, 1811; died 1835). *Leguminòsæ*. Herbaceous plants, of which 3 species were once advertised by collectors of north-

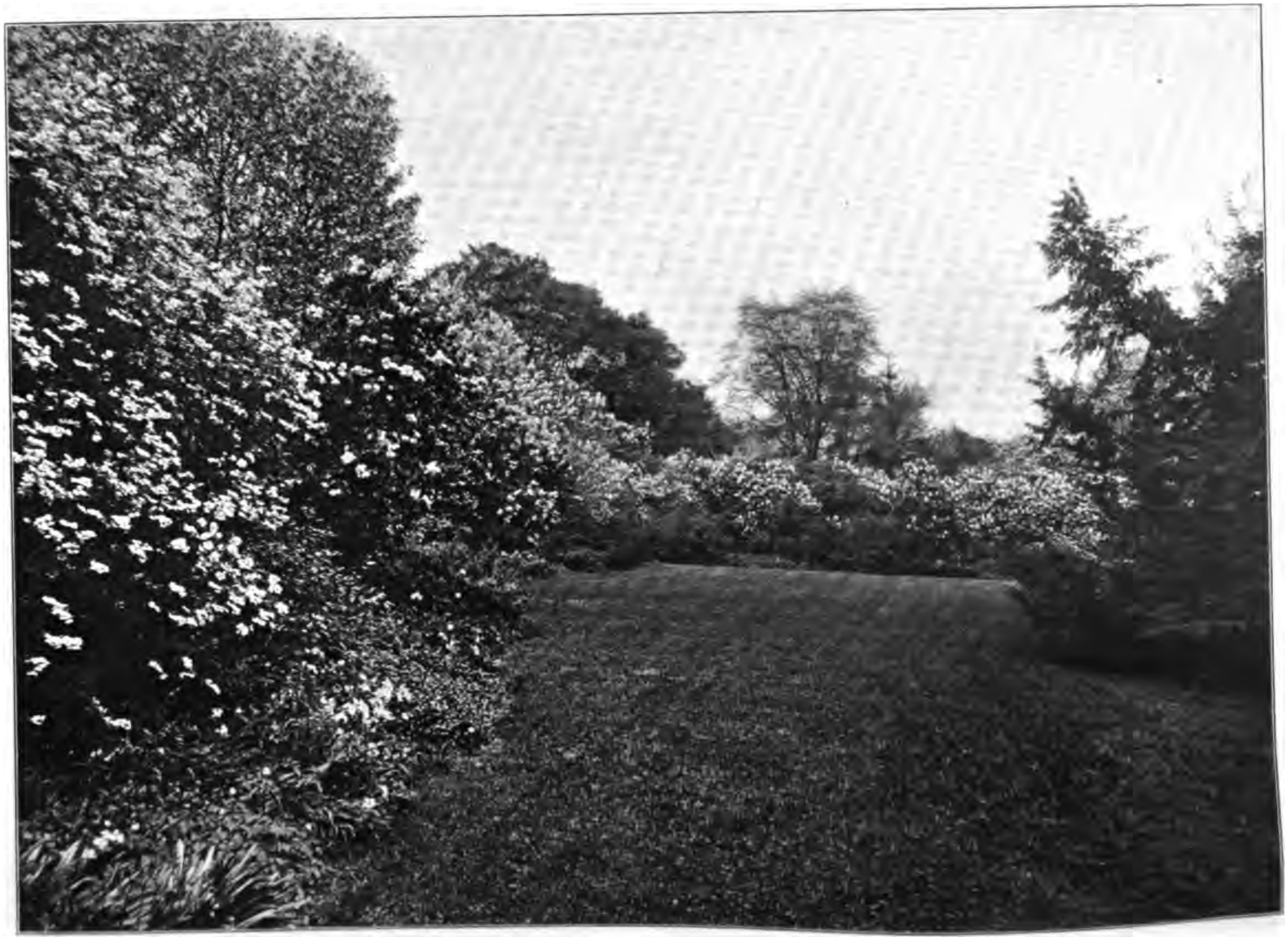


Plate XV. A modern landscape garden.—The Spring Garden of Mrs. J. L. Gardner, Brookline, Mass.

west American plants. The genus contains about 30 species, all American and almost wholly confined to the Pacific slope. Herbs or rarely subshrubs: lvs. pinnate, with 2 to many lfts.: stipules minute and gland-like, rarely scarious or leafy: fls. yellow or reddish, in axillary umbels which are peduncled or not. The genus is closely related to Lotus, but the calyx teeth are shorter than the tube: keel obtuse: lvs. usually with numerous lfts., none of which are like stipules, while Lotus has calyx lobes usually longer than the tube, a rostrate keel and 5 or 4 lfts., of which 2 or 1 are stipule-like.

The 2 species first mentioned belong to a section in which the pods are shortly acute, linear, many-seeded, straight, glabrous: fls. and fr. not reflexed: peduncles long. The third species belongs to a section in which the pods are long-attenuate upwards, incurved, pubescent: peduncles short or none: fls. and fr. reflexed. Monogr. by Watson in Bot. Calif. 1:133.

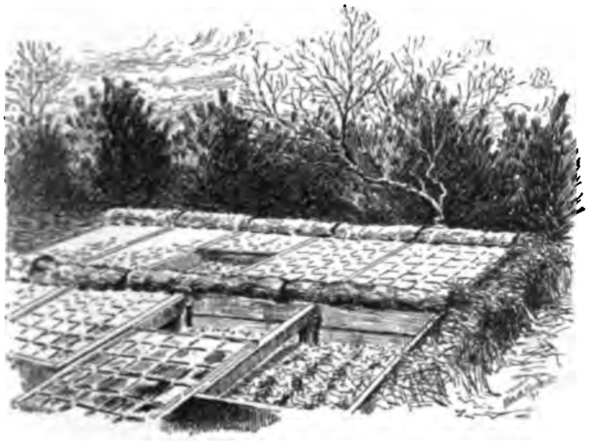
crassifòlia, Benth. Stout, 2–3 ft. high, nearly glabrous: lfts. 9–15, thickish: stipules scarious, small: bract below the umbel: calyx teeth short: pod thick: fls. greenish yellow or purplish. B.R. 23:1977.

bicolor, Dougl. Glabrous: lfts. 5–9: stipules scarious, small: bract usually none or small: calyx teeth half as long as the tube: pod slender: fls. yellow, the wings often white. B.M. 2913.

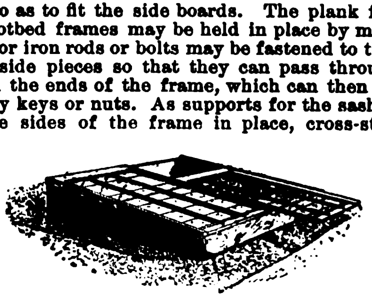
decúmbens, Benth. Silky or woolly, with appressed hairs: stems ascending, 1 ft. or more long: stems herbaceous: lfts. 5–7: umbels less dense: stipules gland-like: pods pubescent.

W. M.

HOTBEDS. These are low glass structures that are generally heated by fermenting vegetable substances, such as stable manure, although fire heat is occasionally applied, steam, hot water and flues being used. Their usual place is some spot sloping to the south, where they are protected by buildings, evergreen screens or board fences, from the north and west winds (Fig. 1096). The frames are made either of plank or boards and may be portable, or built in place, the former being taken down and packed away except when needed. A tight board fence 6 feet high, as a wind-break, is desirable, as it will also serve as a support for the shutters, mats and sash when they are removed from the bed, and it will answer best for this purpose if it inclines a foot or so to the north.


1096. Hotbed sheltered by a hedge.
The straw mats have been rolled off.

When movable frames (Fig. 1097) are used they are generally constructed of 2-inch plank, the side pieces being from 9 to 12 feet and the ends 6 feet in length, to receive either three or four ordinary sash, which are 3 by 6 feet. The north side of the frame is made 15 inches wide, while the south side is but 9 or 10 inches, thus giving a slope to the south, which will permit the water to run off and favor the passage of the sun's rays through the glass. The end pieces are 6 feet in length, but taper from 15 inches at one end to 9 or 10 at the other, so as to fit the side boards. The plank for portable Hotbed frames may be held in place by means of stakes, or iron rods or bolts may be fastened to the ends of the side pieces so that they can pass through the holes in the ends of the frame, which can then be fastened by keys or nuts. As supports for the sash and to hold the sides of the frame in place, cross-strips of board 3 inches wide are sunk into the upper edge every 3 feet, and another strip with a width equal to the thickness of the sash is fastened on edge to the center of its side. Frames of this size require a slightly deeper mass of heating material than would be necessary for larger frames, and when they are to be used during the winter, it is well to excavate to the depth of 2½ feet, and for a space 2 feet longer and wider than the frame, and after the hole has been filled with heating material, the material should be well tramped down. The frame is put in place and manure is then banked about it.

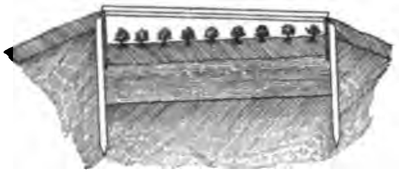

1097. Hotbed with movable frame.

For permanent frames, rough 1-inch boards may be used, although 2-inch plank will be found far more durable. Stout stakes should be driven into the ground about 4 feet apart, where the north line of the bed is to be located. These should project above the surface from 12 to 15 inches, and should be boarded up from a point just below the level of the ground, so that the stakes will be on the north side of the frame. A second row of stakes should then be driven at a distance from the first row equal to the length of the sash, which is usually 6 feet, although other lengths are sometimes used. The south wall of the frame should then be boarded up so that it will be 5 or 6 inches lower than the north wall, after which the end should be closed and cross-pieces should be fitted, the same as for the portable sash. To prevent frost from working into the frame, soil should be taken from the inside and banked against the boards outside, so that it will reach two-thirds of the way to the top of the frame, and when the bed is ready for use, 3 or 4 inches of horse manure should be spread over this. The frame should be placed about 3 feet from the fence, and if other rows are needed, there should be alleys about 7 feet wide between them.

Hotbed Sash.—The size that has been found most satisfactory for Hotbed sash is 3 by 6 feet, as when larger than this they are not readily handled by one man. While pine and other native lumber may be used; cypress is generally preferred, as it is much more durable and costs but little if any more than clear pine. The sides and upper ends of the sash are made from 3 by 1½-inch strips, grooved to receive the glass, while the lower end is about 1 by 5 inches. The center strips are 1 by 1½ inches. For glazing Hotbed sash, single strength 10 by 12 glass is commonly used, as three rows of this size will fill a sash 3 feet wide. While double-strength glass will be less easily broken, the increased weight is an objection to its use. The sash should receive two coats of paint, and after the glass, which may be either lapped or butted, has been set, it should be given a third coat.

Mats and Shutters.—For covering the frames on cold nights during the winter and early spring months, straw mats are often used, although those made of burlap are generally preferred. The burlap may be either single or doubled, or it may be stuffed with straw, excelsior or other materials. Quilted mats filled with combination wool are very warm and quite durable. During the winter, wooden shutters are also desirable to place over the mats, as they assist in holding the heat, and by keeping the mats dry, aid in preserving them.

Heating Material for Hotbeds.—To provide heat for the beds decomposing horse manure is generally used. While a large amount of straw is not desirable, the presence of urine-soaked bedding with the manure to the extent of one-third its bulk is not objectionable, as it will lengthen the heating period of the manure. Unless straw is mixed with the manure, it will be well to add forest leaves to the amount of one-third to one-half the amount of the manure. The heating material should be forked over and placed in a pile 5 or 6 feet wide, 3 or 4 feet high and of any desired length. If the manure and straw are dry, it will be well to moisten them with a fine spray. In case there is but a small amount of manure, it will be best to use warm water, though in all cases the soaking of the manure should be avoided. Within four or five days the giving off of steam will indicate that heating has commenced. The pile should then be forked over, working the outer portions into the center.



1098. Hotbed in cross-section.

The amount of heating material that will be required for a Hotbed will vary with the crop, as well as with the location and season. For zero weather, there should be at least 18 inches of heating material after it has been well packed down, and 24 inches will be desirable in midwinter in the northern states, while 6 or 8 inches may answer where only a few degrees of frost are expected. For 18 inches of manure, the excavation should be made to a depth of 28 inches below the level of the south side of the frame, and 31 inches below that of the north side. After the manure has warmed through for the second time it should be placed in the excavation, spreading it evenly and packing it down with the fork, but leaving it for a few days before tramping it. Care should be taken to have the corners well filled, that an even settling may be secured. After the manure has again warmed up, it should be thoroughly tramped.

The bed is then ready for the soil, which should be quite rich and contain a large amount of sand and humus, a compost of decomposed pasture sods with one-third their bulk of rotten manure being excellent for the purpose. The thickness of the soil should vary from 5 to 7 inches, the greater depth being desirable for radishes and other root crops (Fig. 1098). When boxes of plants are to be placed in the beds the depth of soil need not be more than 3 inches. For a few days the bed will be quite warm, but when the temperature of the soil has dropped below 90° the seeds may be sown or the plants set out.

In severe weather the mats and shutters should be placed on the bed at night and should be removed in the morning. When the sun is shining, or if the bed is very hot, it should be ventilated by raising (Fig. 1099) or slipping down (Fig. 1097) the sash, the amount depending upon the season and the condition of the bed. By the middle of the afternoon the sash should be closed and the covering should be replaced before night. When used in the winter time, the Hotbed should be either sunk in the ground or well banked up with soil or manure, so as to keep out the frost.

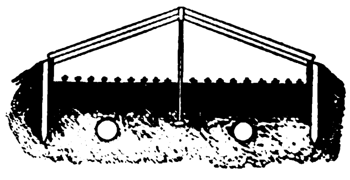
1099. Ventilating the Hotbed.

Pipe-heated Hotbeds.—Fire Hotbeds are generally from 10 to 12 feet wide, with a span roof. A Hotbed of this size would require two lines of 6-inch sewer pipe as flues (Fig. 1100), with furnaces in which wood can be burned at their lower ends. In order that a good draft can be secured, it is advisable to have it upon a side-hill sloping to the south. When hot water is used for heating Hotbeds, a 2- or 2½-inch wrought-iron pipe is placed just beneath the ridge as a flow pipe, with one or two 2-inch pipes upon each of the side walls, the number varying with the season and the crops to be grown (Fig. 1101). Steam may be used in the same way, but the pipes should be one or two sizes smaller.

In the northern states the use of Hotbeds for growing crops during the winter months is not advisable, as better results can be secured in greenhouses, which will not be very much more expensive to build, and will be more durable besides much easier to handle, but in the spring Hotbeds are very useful for starting vegetable and bedding plants, as well as for growing lettuce, radishes and other vegetables. In the South fire Hotbeds answer very well for use in the winter for growing plants for the truck garden, as well as for forcing vegetables, but even there the simply constructed greenhouses are more satisfactory.

Coldframes differ from Hotbeds only in lacking artificial heat, as they depend entirely upon the sun. The surface of the soil should be from 6 to 12 inches below the glass, and a large amount of plant-food should be provided. Coldframes are often used for wintering half-hardy plants, and for starting and growing plants in the spring, after danger from severe frost is over.

Management of Hotbeds.—If the weather is mild during the latter part of February, the manure can be procured and prepared for use so that the Hotbed may be started about the first of March. If properly constructed they will provide heat for two months, and can then be used during May as a coldframe, thus making it possible to take off two crops in the spring. Although it is not often practiced, they may be used in the fall for growing a crop of lettuce or other vegetables, which can be matured before the first of December.



1100. Fire Hotbed.

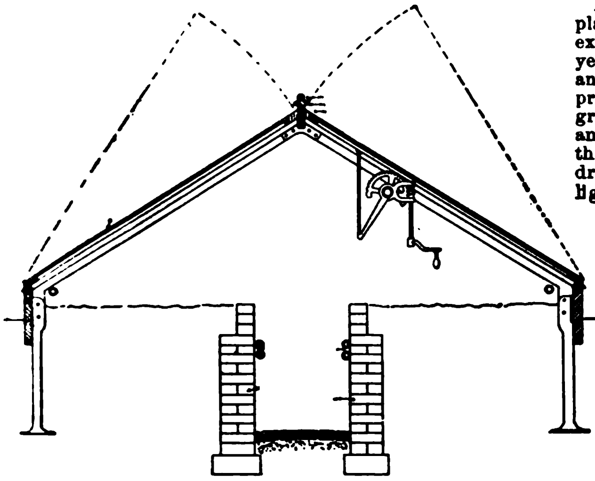
If a greenhouse is not available for starting the plants, seeds of lettuce, radishes, cabbages and other of the hardier plants may be sown in the Hotbed in the spring as soon as it is ready, in rows 4 or 5 inches apart. When the first true leaf appears, the radishes should be thinned and the other plants transplanted to about 2 inches. Later on, the lettuce plants should be placed about 8 inches apart each way. If the weather is so cold that the bed should not be kept open, the seeds may be sown and the first transplanting may be in flats or boxes, which can then be placed in the beds. Aside from proper ventilation, covering and watering, the beds should be occasionally weeded and the soil stirred. About the first of April, tomatoes, cucumbers and similar plants may be started. As soon as one crop is taken off another should be placed in the beds, and by deepening the soil they may be used during the early summer for growing cauliflower, tomatoes and cucumbers. L. R. Taft.

HOTÈIA. See *Astilbe.*

HOTTENTOT BREAD. *Testudinaria elephantipes.*

HOTTÒNIA (Peter Hotton, 1648–1709, professor at Leyden). *Primulàceæ.* Featherfoil. A genus of two species of aquatic plants, the only aquatic members of the primrose family. They are suitable for small aquaria. The European species is procurable from dealers in aquatics; the American one can be gathered in shallow, stagnant ponds from Massachusetts to western New York and south to Florida and Louisiana. The European plant, **H. palústris**, Linn., is an herb with creeping rootstock, whorled, leafy branches entirely

submerged and alternate, pinnately dissected lvs., the divisions numerous and linear. From the center of the whorl of branches a single leafless flower-stem rises out of the water in summer, bearing a raceme with several whorls of 3–5 or 6 handsome, pale purple fls., apparently with 5 petals, but actually with a short corolla tube below the lobes. The plants root in the mud or float, and the fls. are about three-fourths of an inch in diameter. Stamens 5, inserted on the tube of the corolla: capsule subglobose, with 5 lateral valves: seeds numerous. The American plant, H. inflàta, Ell., has spongy stems and clustered peduncles, which are partly above water, inflated, jointed, the lowest joint 2–4 in. long and sometimes 1 in. thick, the others 1–3 in number and successively shorter: fls. small, in whorls of 2–10 at the joints. B.B. 2:586. Neither species is advertised. Like all aquarium plants, they are interesting, but they have no horticultural value otherwise. Both plants are called Featherfoil and Water-violet; the American also Water-feather and Water-yarrow.



1101. Hotbed (or forcing-house) heated by hot water.

HOULLÈTIA (after Houllet, French gardener). *Orchidàceæ.* About 8 species of epiphytic, pseudobulbous orchids from South America, allied to Stanhopea, and blooming in summer. Pseudobulbs conical, 1-leaved: lvs. lanceolate, plicate: sepals and petals usually nearly equal: labellum continuous with the clavate, arcuate column: pollinia 2, on a long caudicle.

odoratíssima, Linden. Sepals and petals reddish brown: labellum white, with two crimson appendages midway of its length. Colombia. G.C. II. 24:777. Var. **Antioquiénsis,** André (*H. Antioquensis*, Hort.), has labellum white, tinged yellow. I.H. 17:12.

Brocklehurstiàna, Lindl. Fls. 5–8, about 3 in. across, brownish red, dotted with brown-purple; sepals oblong, obtuse, the lateral ones slightly united at base; petals narrower, obovate; labellum yellow, thickly dotted with brown-purple; from its lower half two linear appendages have their origin. Braz. B.M. 4072. P.M. 9:49. R.H. 1885:492.

picta, Linden & Reichb. f. Fls. 6–10; sepals oblong, brownish, unspotted above, tessellated with yellow below; petals similarly colored; labellum yellow, spotted or dotted with brown-purple or red-purple, the end hastate: apex recurved, pale yellow veined with crimson. Colombia. B.M. 6305.

Wállisii, Linden & Reichb. f. (*H. chrysántha*, Lind. & André). Fls. about 2 in. across; sepals and petals yellow, blotched inside with brown-purple; labellum yellow, dotted with crimson. Colombia. G.C. II. 18:437. I.H. 18:71.

Oakes Ames.

HOUND'S TONGUE. See *Cynoglossum.*

HOUSE LEEK. *Sempervivum tectorum.*

HOUSE PLANTS (Figs. 1102–1104) are those plants which can be grown in the ordinary rooms of dwelling houses. They may be hardy or tender; but only such as are suitable for this purpose will be considered here.

In the living rooms of the modern well-built house, plants must contend against difficulties which did not exist in the less carefully equipped dwellings of fifty years ago or earlier. The present methods of heating and lighting, by gas or kerosene lamps, not electricity, produce a dry atmosphere which is inimical to vegetable growth. In houses lighted by electricity, and heated by any system which introduces fresh air in abundance, this matter is not so troublesome. Too much heat and dry air are harder for plants to endure than insufficient light, but it is also lack of light which makes it so difficult to grow flowering plants in houses. Dust and insects do harm, but these difficulties can be overcome.

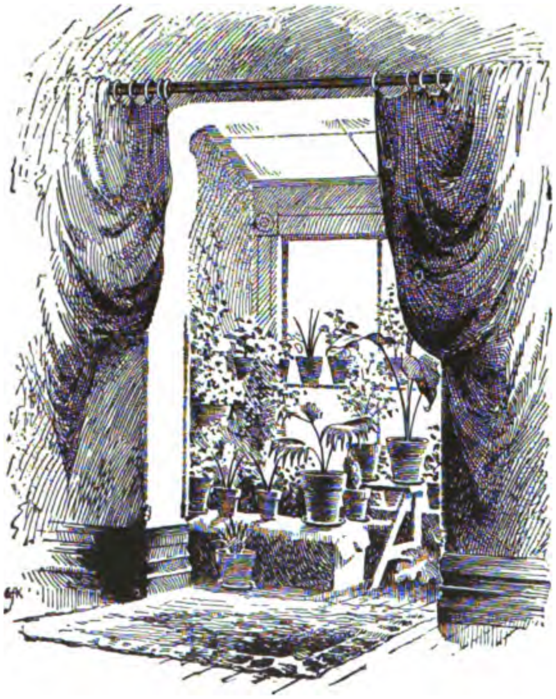
For the above reasons it is important to select House Plants which are adapted to resist a dry atmosphere, a high temperature and inadequate light. Such examples can be found among certain tropical plants with coriaceous leaves and small stomata, what the florists call foliage plants, e. g., rubber trees, palms, etc. These make the best foundation upon which any successful system of growing plants in houses can be built. Flowering plants can also be used, but they should be introduced from time to time, each in its proper season, when about to bloom or in bloom, and not considered a part of the permanent arrangement. After flowering they should be removed: their function is not unlike the use of cut-flowers, but they last longer and are not much more expensive, while they largely increase the attraction of the window-garden.

The best rooms for plants are those which get the most sun, and the best positions are those nearest the windows, where there is not only more light but more fresh air. A large palm, fern or rubber will grow in an entry or poorly lighted corner, but the best place is that which is best lighted. Plants do well in a kitchen, the moisture from the cooking helping them materially; it is by no means a bad hospital for unhealthy specimens.

1102. Pot-plants in the window.

Sometimes a plant-room, not a conservatory, can be set aside for this purpose exclusively. If this is done in the basement, and it is possible to get good light, satisfactory results are obtained. The floor can be made of concrete and water used without stint. In such a room plants can be grown and brought into the living rooms when in their best condition.

In rooms in which plants are kept, any device by which the atmospheric moisture can be increased is desirable: oilcloth on the floor, or a floor of porous tiles; a zinc tray, in which the pots can be set and surrounded with moss; saucers under the pots, the pots being raised slightly to prevent the roots of the plants standing in the water which runs through. By these aids not only can plenty of water be given to the roots, but there will also be some opportunity to sprinkle the leaves, while the evaporation of surplus water will dampen the air. The Japanese porcelain pots are not only ornamental but useful; the glaze prevents undue evaporation from the sides, and the legs hold the pot well above the water which may collect in the saucer: they are in every way excellent. Wooden tubs are serviceable for large plants or for any which are likely to be exposed to frost, either before or after bringing into the house. Plants should never be overpotted, but the larger the bulk of earth the easier it can be kept uniformly moist; from the wider surface, too, there is more evaporation. For these reasons it is sometimes a good plan to have window boxes in which several plants can be grown; or the boxes can be filled with moss in which the pots can be plunged. All pots, tubs or boxes for growing plants should have holes in the bottom through which water can pass freely.



1103. A window-garden.

Much trouble is likely to come from the use of unsuitable potting soil. Procure it from an experienced florist, or make it yourself of equal parts rotted sods, old leaf-mold, well-decayed cow manure and clean, sharp sand: discard tea leaves, chip dirt, and the decomposed remains of dead stumps. The soil should always be moist when used, not too wet and never dry: it should be made firm, not hard, and a good space left between the surface and rim. Large pots should be drained with potsherds and moss. The best time for potting is just before the plant begins to grow; the next best is just before growth ceases, thus giving the plant opportunity to establish itself in its new quarters before it stops growing. It is not always easy to do this properly at home, and large and valuable plants should be sent to a florist. Plants growing in the open air should be lifted and potted two weeks or more before bringing into the house, not only before frost but before the nights are cool. Keep them at first in a cool, shady place, gradually accustom them to the sunlight, and carefully avoid all drafts. Do not give too much water at the root: some wilting is unavoidable, and cannot be prevented by heavy watering. Give one good application when they are first potted, and sprinkle the foliage and surroundings in the middle of the day. After they are established, keep them out of doors, on the piazza or porch, until there is danger of frost, but try to bring them into the house before the furnace fires are lighted.

A period of rest is natural to all plants. Amateurs often make mistakes in trying to force plants to grow all winter in the house after a vigorous growth in the open ground all summer. Such plants should be rested, kept cool at first and water withheld, but never to such an extent as to shrivel the wood. No rules can be given for watering, the most important detail of plant-growing. Water must be given as it is required, a knowledge to be gained from experience only. This may be once a day or once a week, twice a day or once in two days. The smaller the pot and the more vigorous the growth, the oftener it will be required. In hot weather and in dry rooms more water is needed than in cool rooms and on damp, cloudy days. It should always be given in sufficient quantity to pass through the hole in the bottom of the pot: here it can remain an hour or more, and part of it will soak up, back into the pot, but the surplus should be taken away with a sponge, unless the pot has legs or it is a plant like calla, English ivy or some ferns. which are uninjured by an over-supply. Water given to the foliage of House Plants in the form of spray is always helpful.

Insects, dust and sometimes fungous pests are troublesome to House Plants, due largely to insufficient watering and lack of ventilation. The best remedy is frequent washings with warm water and a sponge for plants with large leaves. All plants can be easily cleaned at the kitchen sink or in the bath tub, or advantage can be taken of a mild day, and the work done in the yard with the hose. The forcible application of water will remove most insects, but if scale appears it must be taken off with a stiff brush. Whale-oil and tobacco soap are too rank for house use; fir-tree oil and Gishurst's compound are less obnoxious. They can be used when the plants are washed with sponge or brush. The florists' preventive against greenfly is impracticable: enough tobacco smoke to harm him would not be tolerated. The red spider can be driven off by spraying with an atomizer, if discovered in time. Some plants are not attacked by insects, but are injured by dust, e.g., the rubber-tree. Dusting when dry is better than nothing, but washing is best. If fungous diseases appear, the plants should be isolated, giving a chance to recover, or be thrown away.

Ventilation is an important factor in keeping House Plants in good condition. Open the windows on bright days: the fresh air is moist and therefore grateful, and will do no harm, even if the plants are near the glass, so long as the sun shines and discretion is exercised.

The night temperature need never exceed 50° F., and a drop of 5° or even 10° is not likely to do any harm. Precautions must be taken to exclude frost; the blinds must be shut and the curtains pulled down on cold nights. A layer of newspapers between the plants and the windows is a protection in extremely bad weather, or a large kerosene lamp can be allowed to burn all night near the plants.

A list of suitable foliage plants for the house: *Ficus elastica*, the rubber plant; *F. religiosa*, the peepul tree, and most of the other strong-growing evergreen species. *Livistona Sinensis*, *Corypha australis*, *Chamærops Fortunei* and *Rhapis Japonica*, all good fan-palms (the first is the best); *Phœnix reclinata*, *P. rupicola* and *P. Canariensis* are the best date-palms. *Seaforthia elegans*, *Howea Belmoreana*, *Kentia Forsteriana*, *Areca Baueri*, *A. rubra* and *Cocos Weddeliana* are all good palms, but require more care than the fan and date-palms. *Cycas revoluta*, the sago-palm, *Curculigo recurvata*, *Aspidistra lurida*, *Pandanus utilis*, the screw pine, *P. Veitchii*. *Phormium tenax* (New Zealand flax), *Cyperus alternifolia*, *Papyrus antiquorum*, Cordyline (Dracæna), *Agave*

Americana (the century plant), Pittosporum, *Grevillea robusta*, English ivy, all do well in ordinary rooms. *Daphne odora*, Laurestinus, *Olea fragrans* and orange tree are both flowering and foliage plants, but require a cooler room than any of the preceding varieties.

Good flowering plants are *Azalea Indica* and *Camellia Japonica*, both of which should be kept in a cool room when not in bloom. Calla and begonia both do well. Chrysanthemums, cyclamens, Chinese and English primroses, freesia, ixia, oxalis, fuchsia, mahernia, euphorbia, heliotrope, pelargonium and lily-of-the-valley can be brought into the rooms when in flower, and last a reasonable time in good condition. Hyacinths, tulips, narcissus and crocus, if potted in October, kept covered up out of doors until cold weather, stored in a cool cellar until the middle of January and then brought into warm rooms, will give flowers: a succession can be maintained by bringing them into warmth at intervals (see *Bulbs*). B. M. Watson.

HOUSTÒNIA (Dr. Wm. Houston, of the early part of the eighteenth century). *Rubiàceæ*. About 20 North American small herbs or subshrubs, with pretty white, blue or purple fls., some of the species occasionally cult. in wild gardens and rockeries. Parts of the fls. in 4's, the corolla gamopetalous and funnel-form or salver-form; stamens and styles polymorphous; stigmas 2: capsule opening near the top: lvs. small, opposite. A moist, partly shaded place is to be recommended for most Houstonias, because their flowering season is thereby prolonged and the plants retain their foliage much longer than in a drier and sunny position. Collected plants are not difficult to establish. Prop. by division. The following perennial species are offered by American dealers.

A. *Stamens or stigmas conspicuously exserted.*

purpùrea, Linn. Tufted, 3–12 in. high, bearing offsets, glabrous or pubescent: radical lvs. ovate or oblong, short-stalked: fls. in late spring or summer, the corolla funnel-form, light purple to white. Canada to Texas.—Var. **longifòlia**, Gray, 3–6 in. high, thinner-lvd. and mostly glabrous: lvs. oblong-lanceolate to linear, ⅓-1½ in. long. Var. **tenuifòlia**, Gray, is slender and diffuse, 6–12 in. high, with almost filiform branches and peduncles: stem-lvs. linear. This species and its forms grow well in dry, open places.

AA. *Stamens or stigmas little or not at all exserted.*

cærùlea, Linn. Bluets. Innocence. Quaker Lady. Fig. 1105. Little tufted perennials, 3–6 in. high, the stems glabrous: radical lvs. spatulate to obovate, hairy, short-petioled, the stem-lvs. small: corolla salver form, the tube much exceeding the calyx lobes, varying from blue to white, with a yellow eye. B.M. 370. D. 233.—Charming little plant in grassy places in the northeastern states and southward in the Allegheny region. Excellent for rockwork and grassy borders. Early spring. In gardens, may be treated as annual or biennial.

serpyllifòlia, Michx. Extensively creeping: radical lvs. orbicular to ovate-spatulate and abruptly petioled: corolla rather larger than that of *H. cærulea*, deep violet-blue (often white). Va., southward. Early spring.

J. B. Keller and L. H. B.

HOVÈNIA (after David Hoven, Senator of Amsterdam). *Rhamnàceæ*. Ornamental shrub or small tree, with deciduous alternate, long-petioled lvs. greenish inconspicuous fls. in axillary peduncled cymes, and with small globular frs. on reddish, fleshy and edible peduncles. It grows into a small, round-headed tree, with handsome somewhat shining foliage, and thrives best in sandy loam, but is not hardy north. Prop. by seeds, also by root-cuttings and cuttings of ripened wood under glass. One species in Himal., China and Japan. Without stipules: calyx lobes, petals and stamens 5, style 3-parted: fr. 3-celled and 3-seeded, indehiscent.

1104. An attractive corner of Pandanus, Begonia, and Wandering Jew.

dùlcis, Thunb. (*H. inæquàlis*, DC.). To 30 ft.: lvs. cordate-ovate or ovate, acuminate, serrate, almost glabrous, 4–6 in. long: cymes many-fld. S.Z. 73–74. B.M. 2360. A.G. 12:80. Alfred Rehder.

HOVEY, CHARLES MASON (Fig. 1106), horticultural journalist and nurseryman, was born in Cambridge, Mass., Oct. 26, 1810, and died there Sept. 2, 1887. He is best known as editor of the "Magazine of Horticulture," which had an uninterrupted existence from 1835 to 1868. It was founded as the "American Gardener's Magazine," by C. M. Hovey and his brother, Phineas Brown Hovey. In its third volume (1837) it changed its name, and continuously thereafter was known as the "Magazine of Horticulture," and was edited by Charles M. Hovey alone. It enjoyed the longest period of prosperity of any American horticultural journal. It is a record of the budding stage of New World horticulture. It was modelled after Loudon's "Gardener's Magazine," although its spirit was essentially American. Essays, records of current events, reviews of books, descriptions of varieties, were prominent features. It had very few illustrations. Mr. Hovey was author of the "Fruits of America," issued in parts from 1852 to 1856, completing two volumes and making more than a beginning on a third. Its purpose was to give "richly colored figures and full descriptions of all the choicest varieties cultivated in the United States." The volumes contain more than 100 colored plates. Handsomely printed and bound, these volumes are a fine type of the amateur's art-book of varieties.

Mr. Hovey was also nurseryman and seed merchant. Until 1840, his grounds at Cambridge are said to have comprised only an acre, but at that time his premises were greatly enlarged. His epoch was a time of knowledge of varieties. Straightway he began assiduously to collect varieties, until he exhibited pears, apples and camellias by the hundreds, and plums, grapes, chrysanthemums and many other things by the score. These things were shown before the Massachusetts Horticultural Society, which was the center of horticultural influence of the country. He raised many seedlings. *Thuya Hoveyi* is still prized as a garden conifer. His greatest contribution to horticultural varieties was the Hovey strawberry, which first fruited in 1836, and which is generally regarded as the starting-point of American commercial strawberry-growing (see Fig. 1088). For many years this berry was the standard of market excellence. Mr. Hovey continued to grow it and cherish it until the end. The writer remembers with what enthusiasm he expatiated on its virtues but a very few years before his death. Mr. Hovey was long an active member, and for a time president, of the Massachusetts Horticultural Society. He was one of the active projectors of the building which gave the Society a new and more commodious home. The history of the society records that, when the project was in doubt, "the perseverance and determination of the president of the society and chairman of the building committee, Charles M. Hovey, triumphed over every hindrance, and carried the work on to success."

1105. Bluets—Houstonia cærulea (×½).
(See Houstonia, p. 777.)

A portrait of Mr. Hovey will be found in the first volume of the "Fruits of America." Another occurs in "Gardeners' Monthly" for 1886 (frontispiece) and "American Garden," Nov., 1887; and a reduction of this appears in Fig. 1106. L. H. B.

HÓWEA (named for Lord Howe's Island, where these 2 species grow). Also written *Howeia*. *Palmàceæ*. A genus of only 2 species, known to the trade as Kentias, and certainly ranking among the 6 most popular palms for house culture. They have the habit of Kentia, but their fls. differ widely. Howea belongs to a subtribe in which the fls. in each spadix are attached to the stem between the bases of opposite lvs., while Kentia belongs to another subtribe in which the fls. are attached at a lower point. Also Howea has symmetrical staminate fls. with rotund sepals, while in Kentia the staminate fls. are not symmetrical, the sepals being small and acute. Howea's nearest cultivated ally is Linospadix, from which it is distinguished by the following characters: staminate fls. with very numerous stamens, the anthers erect and fastened at the base: pistillate fls. with no staminodes: ovule erect. *H. Belmoreana* is the more popular of the two species, and as a house plant may be readily told from *H. Forsteriana* by the more nearly erect position of its leaf segments; those of *H. Forsteriana* are more pendent. Howeas are erect, spineless palms, with stout ringed caudex: lvs. terminal, numerous, dense, equally pinnatisect: segments narrow, acuminate: spadices 2–3 ft. long, solitary or 3–5 from 1 spathe, thick, cylindrical, nodding or pendulous: peduncle long, compressed at the base: spathe solitary, as long as the spadix, cylindrical, 2-keeled toward the apex, longitudinally split: bracts bordering the channels; bractlets scaly: fls. sunk in the deep furrows of the spadix, the staminate nearly an inch long: fr. 1½ in. long, olive-shaped.

Belmoreàna, Becc. (*Kéntia Belmoreàna*, F. Muell.). CURLY PALM. Fig. 1107. Described and distinguished above. B.M. 7018. R.H. 1897:256 and p. 257; G.C. III. 8:75. I.H. 21:191. A.G. 13:141; 16.345. Mn. 9:25.—Var. **variegàta**, Hort. Adv. 1895 by Pitcher & Manda.

Forsteriàna, Becc. (*Kéntia Forsteriàna*, F. Muell.). FLAT OR THATCH LEAF PALM. G.C. III. 8:75 and 533. S.H. 2:53. A.G. 16:346. A.F. 4:565; 14:701.

JARED G. SMITH and W. M.

The two species of this genus are beyond a doubt the most popular and also the most satisfactory palms in the trade for decorative work in general, and in consequence of the great and growing demand, are grown by tens of thousands in the large nurseries. There does not seem to be any record of either of these species having borne fruit in cultivation in this country, and the trade, therefore, depends on imported seeds, which are gathered in immense quantities on Lord Howe's Island, usually shipped from thence to Sydney, N. S. W., and from the latter port to either London or New York. This long voyage is a severe test of the vitality of such seeds, and frequently results in faulty germination, the average of germination seldom exceeding 50 per cent, and is often much less. Two heavy shipments of Howea seeds are made each year, the first installment arriving in February or March, and the second in September or October. Many growers favor the autumn shipment of these seeds as giving the best results. The seeds should be sown at once on their arrival, the practice followed by large growers being that of broadcasting the seeds on a side-bench in a warm greenhouse on 2 to 3 inches of light soil, then covering them with 1 inch of the same compost, watering liberally and keeping up a bottom heat of about 80°. Under such treatment some of the seeds may germinate in two months, but others in the same lot may not start for eight or nine months, from which it will be seen that the operation extends over a considerable period of time. The seedlings should be potted into small pots when the first leaf is expanded, kept moist and given a night temperature of 65°, the greenhouse in which they are

1106. Charles M. Hovey.

placed being moderately shaded. In three to four months the young plants should be ready for shifting into 3-inch pots if properly cared for; from this time forward they do not require a higher night temperature than 60°. The Howeas are not very particular in regard to soil, a rich, light loam answering very well for them, but a very stiff soil may be improved by the addition of one-fourth part of peat, and in all cases a reasonable proportion of fertilizers may be used to advantage. Scale insects are the most troublesome the grower has to contend with, and should be removed as rapidly as possible, else the foliage will be permanently disfigured. Of the two species referred to, *H. Belmoreana* is perhaps the greater favorite, being more compact in growth and extremely graceful in foliage, a plant of this species of a given age usually carrying a greater number of leaves than one of *H. Forsteriana* of the same age, and the leaves having more leaflets than those of the latter species. The seeds of the two species are very similar in appearance, though those of *H. Belmoreana* frequently average a larger size, and while those of the last named species require about three years to mature on the tree, the seeds of *H. Forsteriana* ripen in about twelve months. For house culture by amateurs, see *Palms*.

W. H. TAPLIN.

HÓYA (Thomas Hoy was once gardener to the Duke of Northumberland). *Asclepiadàceæ.* More than 50 tropical Asian and Australian climbing or trailing evergreen shrubs, bearing thick, opposite lvs., and odd, often showy fls. in umbel-like clusters. Corolla rotate, 5-lobed, thick and more or less waxy in appearance: crown of 5 thick and depressed fleshy appendages: pollen-masses 10, short, fixed by their base in pairs to the 5 glands of the stigma: follicles acuminate, smooth: stems twining, or climbing by means of roots.

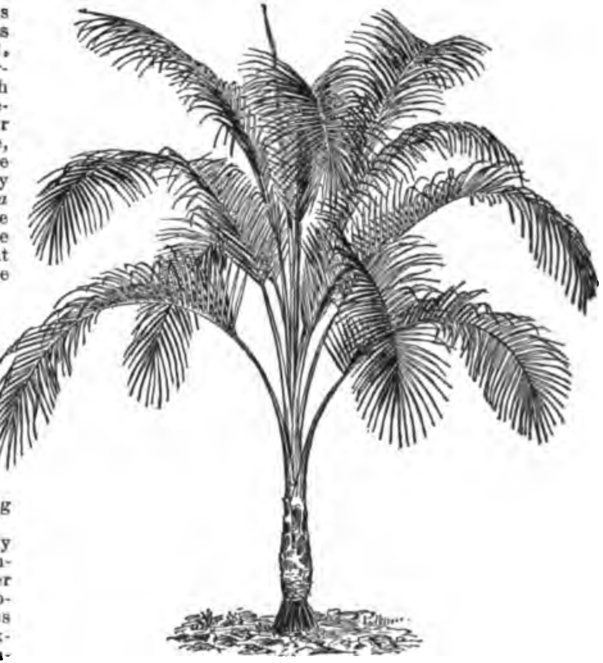
Hoyas are summer-blooming plants, of comparatively easy culture. They need an intermediate or warm temperature. Let them rest or remain very slow in winter (50° in a dryish place), but start them into growth towards spring. In the summer they are sometimes plunged in the border, but better results are to be expected, as a rule, by keeping them in pots in the conservatory. In their growing and blooming season, give plenty of sun and air. They propagate by cuttings of the top growth in spring, and also by layering. The latter method is particularly adaptable to *H. carnosa* and other species which climb by means of roots. A. P. Meredith advises as follows: "For compost, use fibrous loam, lumpy (or coarse) in two parts, to one of leaf-mold, using charcoal pounded fine, brick dust, or lime rubble if procurable, instead of sand. They are often found doing well in loam and sand. When in growth use weak liquid manure."

A. *Plant distinctly climbing.*

carnòsa, R. Br. (*H. Motóskei*, Teijsm.). WAX PLANT. Twiner, and attaching itself to support by means of roots; ordinarily grown as a pot- or tub-plant, and reaching 5–8 ft. high, but growing twice and more this height when it has the opportunity: glabrous: lvs. succulent and shining, ovate-oblong, acute, short-stalked, entire: fls. white with pink center, fragrant, in axillary or interpetiolar umbels, the crown-segments very convex, and spreading into a horizontal star. Trop. Asia and Austral. B.M. 788, as *Asclepias carnosa*. A.G. 18:34.—The common species, and often seen in window-gardens. After the bloom is over (in summer) keep the plant in a cool place in order that it may remain half-dormant. In late winter or spring, start it into growth. Do not cut off the spur which remains after the fls. pass, for this spur bears fls. again. The Wax Plant is easy to manage, and it improves with age. Often trained as a permanent cover for a glasshouse wall. In the South, it is nearly everblooming. There is a form (var. *variegàta*) with handsome variegated lvs. L. 44.

globulòsa, Hook. f. Hairy: lvs. elliptic-oblong or long-oblong, acuminate, rounded at the base, the midrib very stout, the petiole an inch or less long: fls. pale straw or cream color, the star-like crown-segments white, with pink at the base, borne in dense, globular umbels: follicles a foot or more long. Sikkim. F.M. 1880:406. G.C. II. 17:741.—A handsome species, requiring the general treatment given to *H. carnosa*.

imperiàlis, Lindl. Lofty climber, with puberulent stems and foliage: lvs. elliptic or linear-oblong, obtuse but with a short point: fls. immense (2–3 in. across), leathery, dull purple, somewhat pubescent near the white crown, the segments triangular-acute: umbels drooping on long peduncles: follicles 9 in. long. E. Indies. B.M. 4397. F.S. 4:393–4.—A noble Hoya, requiring very rich soil and a rather high temperature. Although naturally a very tall climber, it can be made to flower in pots when 3 or 4 ft. high.



1107. Howea Belmoreana.
One of the most popular of all palms.

AA. *Plant trailing or nearly erect.*

bélla, Hook. (*H. Fàxtoni*, Hort.). Slender, bushy, 1–2 ft. high, pubescent: lvs. an inch long, ovate-acute, very short-stalked, somewhat recurved: fls. ¾ in. across, pure white, with very short and half-acute lobes, the crown-segments boat-shaped and violet: umbels few-fld. and short-stalked. India. B. M. 4402. F. S. 4:399. J.H. III. 35:5.—Handsome little species; scarcely climbing.

L. H. B.

HUCKLEBERRY. See *Vaccinium; also Gaylussacia.*

HÚLSEA (Dr. G. W. Hulse, of La., who collected in Calif.). *Compósitæ.* This includes one of many woolly herbs offered by Californian collectors. It grows a few inches high and bears fls. with 20–30 yellow rays. Six species of herbs, perennial, biennial or annual, all Californian, glandular pubescent or woolly: lvs. pinnately lobed or toothed: fls. large, solitary, yellow or purple; involucral bracts free, narrow; style branches obtuse: pappus of 4 hyaline, lacerated, chaffy scales. Monogr. by Gray in Bot. Calif. 1:385.

nàna, Gray. Stems depressed, leafy at summit: lvs. pinnatifid or incised, petiole long-margined: peduncle 1–2 in. long: involucral scales in 2 series: rays 20–30.

HUMÀTA (Latin, *of the earth;* referring to the creeping habit of the rhizomes). *Polypodiàceæ.* A genus of ferns related to Davallia and sometimes included with that genus, with small, thick, deltoid lvs., with the indusium tough, suborbicular or reniform, attached by a broad base and free at the apex and sides. Some 20 species are known, mostly from the East Indies. For culture, see *Davallia.*

Tÿermanni, Moore (*Davállia Tÿermanni,* Baker). Bear's Foot Fern. Rootstock wide-creeping, densely covered with linear white scales; lvs. 4–6 in. long, deltoid, 3–4-pinnatifid; lower pinnæ largest, the lowest pinnules cuneate-oblong or deltoid; sori at the base of the ultimate lobes less than a line broad. Central China. G.C. 1871:871.
L. M. Underwood.

HUMBLE PLANT. *Mimosa pudica.*

HÙMEA (after Lady Hume). *Compósitæ.* This includes a half-hardy biennial Australian plant, growing 5 or 6 ft. high, cult. for the grass-like beauty of its large, loose, much-branched, drooping panicles. The genus has no near allies of garden value. It belongs to a group of 6 Australian genera which have no pappus. Humea has nothing of the typical beauty of the common garden composites, since it has no rays. Its fls. are exclusively tubular and hermaphrodite, 1–4 in a small head. Other important generic characters are the narrow involucre with scarious or petaloid, non-radiating bracts. Three, at any rate, of the 4 other species are shrubs, with fls. in dense corymbs and involucral bracts rigid or petal-like, while in *H. elegans* the bracts are thin and scarious.

Sow seed from July 1 to Sept. 1. Keep young plants during winter in very cool house in preference to frames, in northern latitudes, on account of losing so much foliage through damping. In spring, or when signs of growth are taking place, repot into larger pots, using a good, rich loam, which has had plenty of manure. They are gross feeders and growers, requiring plenty of water and good feeding. Good plants in 10-in. pots are very ornamental for conservatory or piazza work. The young plants need plenty of light and air, and should be kept nearly dry during the winter. In spring they should be started into growth gradually, and successively repotted until an 8-in. pot is needed. They should not be syringed except when growing rapidly in warm weather. In June the plants can be placed in a subtropical bed that is shielded from high winds, and staked. The foliage has a peculiar and agreeable scent.

élegans, Smith. Lower lvs. ovate-lanceolate or oblong, acuminate, stem clasping or decurrent, 6–10 in. long, wrinkled: fls. variously described as brownish red, pink, ruby-red and rose. *H. álbida,* Hort., is presumably a whitish fld. form of this species, and should therefore be called var. **álbida.** R.H. 1862, pp. 9–10 and 1895, p. 459.
A. P. Meredith and W. M.

HÙMULUS (old Latin name). *Urticàceæ.* Hop. Two or three twining vines, with rough, opposite, palmately lobed or divided lvs. and diœcious fls. in axillary clusters. Staminate fls. with 5 erect stamens and 5-parted calyx, in little drooping, tassel-like racemes: pistillate fls. with an entire calyx or perianth closely investing the ovary, which bears 2 long stigmas, the fls. in pairs under large overlapping bracts, the whole making a cone-like catkin which, when becoming very large, is a "hop."

A. *Plant bearing hops,—the pistillate catkin greatly enlarging in fruit.*

Lùpulus, Linn. Common Hop. Native to Europe and North America, and long cult. for the hops, which are used in the brewing of beer: it is a perennial herb: shoots often grow 25–30 ft. long in the season: rough-hairy: lvs. ovate or orbicular-ovate in general outline, deeply 3-lobed (sometimes 5–7-lobed), or the upper ones not lobed, margins strongly and uniformly dentate, petioles long: staminate fls. in panicles 2–6 in. long: hops (mature pistillate catkins) oblong or ovoid, loose and papery, straw-yellow, often 2 in. or more long, glandular and odoriferous.—Native along rivers and in thickets in the northern states, and southward in the Alleghanies and Rockies. Much cultivated for Hops, and extensively run wild from cultivated plants. The Hop makes an excellent arbor or screen plant. Recent European literature mentions a var. *aureus,* with yellow foliage. The Hop grows readily from cuttings of the shoots, which spring from the crown; also by seeds, but the latter do not reproduce the particular varieties or strains. As a field crop, the Hop is not a horticultural subject, and is not discussed here.

AA. *Plant not bearing hops,—the pistillate catkin not greatly enlarging in fruit.*

Japónicus, Sieb. & Zucc. Annual (or at least treated as such): foliage very like the last, but usually more deeply cut and not less than 5-lobed: catkins not glandular. Japan. G.C. II. 24:716.—Int. to general cult. in 1886, and now one of the most popular of all climbing herbs. It is a very quick grower, plants 10–20 ft. long coming from seed sown in early May. It is very easy of cultivation, and often seeds itself. Var. **variegàtus,** Hort., is the most popular form. Gng. 1:241. A.F. 8:489. The foliage is variously streaked and splashed with white. Seeds of this variety will give a large percentage of variegated forms, and the plants usually show interesting variations. *H. Japonicus* is more popular as an ornamental vine than *H. Lupulus,* because it grows so quickly from seeds, and also because it has such interesting variegated forms; but *H. Lupulus* has a distinct charm in its great hanging Hops. L. H. B.

HUNNEMÁNNIA (John Hunneman, English friend of botany, d. 1839). *Papaveràceæ.* This includes a fine yellow-fld. herb closely allied to the California Poppy (Eschscholzia) and of the same garden value. It is treated as a hardy annual. The genus has but 1 species, a native of Mexico, and agrees with Eschscholzia in having much-cut foliage and spreading lobes of the stigma, but differs in having separate sepals instead of the peculiar hood-like calyx of Eschscholzia, which covers the young flower like a candle extinguisher. The only other genus in the Hunnemannia tribe is Dendromecon, a shrub with entire lvs., separate sepals and 2 erect, stigmatic lobes. For culture, see *Annuals.*

fumariæfòlia, Sweet. Lvs. triternately divided: peduncles solitary, terminal: fls. 2 in. or more across; petals 4; stamens numerous. B.M. 3061.—Sold as Giant Yellow Tulip Poppy.
W. M.

In our trial grounds during 1898, this was one of the showiest and most satisfactory plants in over 400 trials. The seed was sown early in May, and by the middle of July the plants were covered with their large yellow flowers, and they were never out of flower until hard frost. The plants have a bushy habit and beautiful, feathery, glaucous foliage. The flowers have wavy borders, and at times stand up like tulips.
W. F. Dreer.

HUSK TOMATO. *Physalis.*

HYACINTH. See *Hyacinthus,* below.

HYACINTH BEAN. See *Dolichos.*

HYACINTH, GRAPE. See *Muscari.*

HYACINTH, WATER. See *Eichhornia.*

HYACÍNTHUS (name from Greek mythology). *Liliàceæ.* Of Hyacinths there are something over 30 species, the great part South African. Others inhabit the Mediterranean region, and from this source come the common garden Hyacinths. From related genera, Hyacinthus is distinguished by the funnel-shaped or bell-shaped flower, the throat not constricted, the lobes shorter than or at most not much exceeding the tube, the 6 stamens attached to the tube or throat and the filaments thread-like or dilated at the base. Bulbous plants with only radical lvs., and fls. in a raceme or spike. The common Hyacinth is **H. orientàlis,** Linn. (Fig. 1108), with 4–8 thick green lvs. 8–12 in. long, ½–1½ in. wide: scape 8–18 in. tall, stout, bearing an elongated and dense raceme: perianth about 1 in. long, the tube usually ventricose or swollen, the lobes oblong-spatulate, as long as the tube, in many colors, often double in cult. B.M. 995. F.S. 23:2399–2400.—The Hyacinth is extensively grown in Holland for export to this and other countries, and consequently is commonly known as the Dutch Hyacinth. The Roman Hyacinth (Figs. 1109–10) is var. **álbulus**, Baker (*H. álbulus*, Jord. *H. Romànus*, Hort., not Linn.), is smaller and slenderer, lvs. narrower, very erect, fls. fewer, earlier, white or blush, the tube cylindrical and scarcely ventricose, the segments narrower and usually proportionately shorter. Central France, and perhaps in the Mediterranean region. Much used for early bloom. The Hyacinth has been cultivated for some centuries, and it shared some of the early popularity of the tulip in the Netherlands. *H. orientalis* is wild in Syria, Asia Minor, Greece and Dalmatia. For a picture of a Hyacinth bulb, see Fig. 288, Vol. I.

Other species are sometimes seen in the gardens of the curious, particularly **H. amethýstinus**, Linn., Spain, France (B.M. 2425. Gn. 47, p. 147), and **H. azùreus**, Baker (B.M. 6822. G.C. III. 24:191, var. *gigantèus*), Mediterranean region. The former is slender and graceful, with light blue fls. in short racemes, standing nearly or quite ½ ft. high: fls. small, nodding, bell-shaped, with short teeth-like segments. There is a white-fld. form. Good for rockeries. Hardy in the middle states. The latter species is by some considered to be a form of *H. ciliatus*, Cyrill. Looks like a Grape Hyacinth (or *Muscari*): 4–8 in. tall, with strongly canaliculate, glaucous lvs.: fls. blue, fragrant, in a dense spike 1 in. long, tubular, with small teeth. Distinguished from the genus Muscari by the perianth segments being flaring instead of incurved. Hardy in middle states. **H. fastigiàtus**, Bertol. (*H. Pouzòlzii*, Gay) is a Corsican species, which is hardy in southern New England. It is a delicate species, with very narrow lvs., scape 3–5 in. high and shorter than the lvs.: fls. few, in a loose cluster, ¼–½ in. long and light blue (a white form), with oblong-lanceolate segments longer than the tube. B.M. 6663. *Hyacinthus Romànus*, of Linnæus, is not the *H. Romanus* of horticulturists (which is the Roman Hyacinth, *H. orientalis*, var. *albulus*). Linnæus' species is a blue-white, scilla-like plant (see B.M. 939). *H. cándicans* is now referred to Galtonia. For general cultural notes, see *Bulbs*.

L. H. B.

1108. Common or Dutch Hyacinth.

Culture of the Hyacinth.—The perfection of the flower depends largely upon the strength of the roots, and as Hyacinths make all their root growth in the fall, the bulbs should be planted early,—say from the beginning to the middle of October. Any good garden soil suits, provided it is well drained. The ground should be carefully prepared by spading to a depth of 20 inches, so that the roots may pass straight through it to their full development of 12 or 16 inches. If the soil is naturally stiff it may be lightened by the addition of some sand, and if the beds have been occupied by other plants during the summer, some pure old cow manure, well worked in, is recommended. Horse manure should not be used.

The bulbs should be planted 6 inches deep (to the bottom of the bulbs) and very uniformly, to insure simultaneous flowering. The ground having been prepared as above, perhaps the best way is to remove 3 or 4 inches of the soil, level the bed carefully with the rake and set the bulbs in it 5 or 6 inches apart each way, pressing them in firmly, and then covering them evenly with the soil that had been taken out. When winter sets in, the beds should be covered with 2 inches of dry litter or coarse manure. As soon as the shoots appear above ground in the spring, 1 inch of this covering should be removed and the balance when danger from late frosts is past. Unnamed Hyacinths in separate colors can be bought cheaply, and when grown in masses of solid color or in design beds, they make a very rich display.

1109. Roman Hyacinth.

Forcing in Pots.—For this purpose large, solid bulbs should be selected, and potted singly in 5-inch pots in a rich compost of loam, leaf-mold and some sharp sand. A few pieces of broken pot being placed in the bottom for drainage, the pots should be filled lightly, and the bulbs pressed into the loose soil till only the apex remains above the surface. The pots are then buried to a depth of 8 or 10 inches in the open ground for seven or eight weeks, till the roots are developed fully and the sprout is about 1½ in. above the bulb. When taken inside they should be kept in subdued light, at a temperature of about 50°, until the sprout has assumed a vigorous green color. Florists who force large numbers for winter decorations, set them under the greenhouse benches for about two weeks, and then force them in a temperature of 70°. A greater heat than this attenuates the growth and weakens the color. Syringing with water twice a day is recommended, and as the flower-spike develops weak manure water is helpful. The slower Hyacinths are forced the finer and more lasting will be the bloom. Bulbs wanted in flower for Christmas should be potted in September, and for a succession later, at intervals as desired. Single Hyacinths are handsomer and force better than the double, although a few of the latter may be recommended. The following are among the best adapted for forcing and most largely grown by American florists:

Single Blue:
- Baron van Thuyll. China-blue.
- Charles Dickens. Dark porcelain.
- Czar Peter. Light blue.
- King of the Blues. Dark blue.
- Leonidas. Clear blue.
- Queen of the Blues. Light blue.
- Regulus. Porcelain-blue.

Double Blue:
- Charles Dickens. Dark blue.
- Van Speyk. Lilac-blue.

Single White:
- Alba superbissima. Pure white.
- Baroness van Thuyll. Pure white.
- Grandeur à Merveille. Blush-white.
- La Grandesse. Pure white.
- L'Innocence. Pure white.
- Madame Vanderhoop. Pure white.
- Mont Blanc. Pure white.
- Paix de l'Europe. Pure white.

Double White:
- La Tour d'Auvergne. Pure white.
- Prince of Waterloo. Pure white.

Single Red:
- Charles Dickens. Pink.
- Gertrude. Bright pink.
- Gigantea. Bright rose.
- Moreno. Waxy pink.
- Norma. Delicate waxy pink.
- Robert Steiger. Crimson.
- Sultan Favorite. Salmon.

1110. Roman Hyacinth.

DOUBLE RED:
- Bouquet Tendre. Crimson.
- Noble par Merite. Deep rose.

SINGLE LILAC:
- Haydn. Lilac-mauve.

SINGLE YELLOW:
- Ida. Pure yellow.
- King of the Yellows. Deep yellow.

DOUBLE YELLOW:
- Goethe. Bright yellow.

Miniature Hyacinths, or "Dutch Romans," are small-sized bulbs of the ordinary Dutch Hyacinths. They are excellent for growing in groups in bowls, pans or flats, planted close together and treated just like the large Hyacinths when grown in pots.

Culture in Glasses.—Some of the single Hyacinths may be grown very satisfactorily in water. Special glasses for the purpose can be bought from the seedsmen. They should be filled with pure water and the bulb so placed that its base barely touches the water. They are stored in a dark, cold closet or cellar till the roots are developed, and then brought in to the light. An airy, sunny situation and a temperature of about 60° regularly maintained will insure the best results. The glasses should be kept filled by adding water occasionally as required. The following varieties are especially suited for glasses:

Charles Dickens. Pink.
Lord Macaulay. Deep rose.
Mina. Pure white.
L'Innocence. Pure white.
Von Schiller. Dark red.
Grand Lilas. Light blue.
Charles Dickens. Blue.
Baron van Thuyll. Deep blue.
Mr. Plimsoll. Fine blush.
Obelisque. Yellow.
Moreno. Deep rose.
Sir. Wm. Mansfield. Mauve.

Roman Hyacinths.—Instead of one large truss from each bulb, the Roman Hyacinth produces three or four smaller but more graceful flower-spikes. The bulbs arrive in America in August, and by successive pottings they may be had in flower from November till May. They require the same forcing treatment as the larger Hyacinths, but three or four bulbs may be planted in a pot. The florists use wooden flats instead of pots, setting the bulbs close together, 40 or 50 in a flat. By reason of its beauty and exquisite fragrance, its earliness and easy culture, the white Roman Hyacinth is the most popular of our winter-blooming plants. Several millions of these bulbs are grown annually by the florists of our large cities for winter cut-flowers.

The Propagation of Hyacinths.—With the exception of the Roman Hyacinths (which come from the south of France), the world's supply of Hyacinth bulbs is produced in Holland. The soil and climate of that country seem to be peculiarly suitable for bulb-growing, which has been one of the leading industries there for 200 years. The bulbs intended for next year's market are planted in October in carefully prepared, richly manured land, and protected over winter by a thick covering of reed or litter. The flowers are cut when in full bloom in the spring. By July the bulbs are fully ripened, and are taken out of the ground by hand, dried, cleaned and assorted into three grades of quality, according to size. Early in August they are ready for shipping. Overgrown or unshapely bulbs are reserved for propagating. As soon as these are taken out of the ground, three deep cross cuts are made with a sharp knife in the bottom of each bulb. They are then set out, bottom upwards, and covered with loose soil for two or three weeks, during which time the cuts open out and the wounds are healed. They are then taken up and kept spread out on tables in storehouses till October, when they are planted out. When lifted next June nothing of the parent bulb remains but dry skins, on the edges of which from 20 to 30 offsets are fastened. These bulblets are picked off by hand and planted out in the fall, just like large bulbs. This process of planting in fall and taking up in summer for a two months' rest is repeated for four or five years, till the bulbs have attained to marketable size. Another method of propagating is to hollow out the bottom of the bulb smoothly to a point in the center. More offsets are obtained in this way, but they are smaller and take a year or two longer to reach maturity.

New varieties are obtained from seed, but such a degree of perfection in form and color has already been obtained that it is seldom a seedling is produced that proves superior to existing varieties of the same color. Some new varieties are obtained by encouraging any tendency to change of color or form which may be shown by the standard sorts. In this way the single blue Charles Dickens has been changed to single red and to double blue, and again, very recently, to double red, till we have four varieties named Charles Dickens. Last year's catalogue of a reliable Dutch grower contains 340 named Hyacinths. J. M. THORBURN & CO.

HYBRIDS are the products of crossing between species. Of late, the word Hybrid has been used by some writers to comprise all crosses, whether between species or varieties. The justification of this usage is the fact that there are no hard and fast lines between varieties and species, and therefore that hybridism in the old sense is incapable of exact delimitation. The opponents to this usage, however, contend that so long as it is customary to speak of species and varieties as different classificatory categories, it is equally allowable and useful to speak of Hybrids as between species and of cross-breeds as between varieties; moreover, historical custom favors this usage. Common-language terms rarely if ever express absolute or ideal truth: they grow up by custom. Whenever new ideas and discoveries render them inexact, it may be quite as well to invent new terms as to give new and technical meanings to old terms which are thoroughly established in literature. The word Hybrid has always been a specific term, and it were a pity now to make it a generic one, particularly since there is a well established generic term. The generic word, both substantive and verb, is *cross*. Specific kinds of crosses are Hybrids, between species; cross-breeds, between plants of the same species; half-hybrid, between a species and a variety of another species; bigener, between plants of different genera. There are technical terms to designate the various kinds and degrees of crossing.

It was formerly held that inability to make fertile Hybrids is proof that the forms are distinct species; and contrariwise, that plants which make fertile crosses are of one species. Hybridization has also been made a test of genera. These notions are now given up, for crossing and classification belong to two unlike categories of facts. Species and genera are not entities in themselves, but are mere artificial groups made by men for their convenience when writing and speaking of living things. Crossing is a biological phenomenon.

Hybrids are unusual facts in nature; that is, they are rare compared with the whole number of plants. On the other hand, cross-breeds are usual. Most flowers are so constructed as to favor cross-pollination. Cross-breeding is one of the prime means of inducing slight variations and of invigorating a type. Upon the variations which arise from crossing and other means, natural selection operates in the production of new forms. But it is significant that these new forms usually come about slowly and gradually. It is the desire of the cultivator to produce new forms quickly and of pronounced distinctness. He therefore employs crossing between unlike types, or species, hoping thereby to secure wider departures. In nature, the cross-breed is the beginning of a process of breeding: it starts off the variation. Man is often tempted to look upon the Hybrid as the end. If the products of a given cross are not to his liking, he throws them away and tries again. The most expert plant-breeders, however, now hybridize to get a "break," and thenceforth depend chiefly on selection to realize their clear-cut ideals, particularly in seed-propagated plants.

To man Hybrids are of no value unless they can be propagated. By seeds they usually vary immensely: it is difficult to "fix" them so that they will come true. By cuttings or layers or division, however, the character of the parent may be propagated with practical certainty: the original plant is divided, and the parts are put on the market. Nearly all commercial Hybrids are of plants which are thus propagated by asexual parts: Kieffer pear, Hybrid grapes, Wilson blackberry, Wild Goose plum, cannas, roses, begonias, anthuriums, fuchsias, pelargoniums, rhododendrons. Since the Hybrid is variable when propagated by seeds, continued selection, or plant-breeding, must be employed to fix and establish a desirable type.

It is thus seen that hybridization rarely gives rise to dominant horticultural seed-races, but rather to an individual plant which may be disseminated by some divisional means of propagation. The seeds of Hybrids—as of the modern cannas—may give rise to good varieties, and they may not; but these new varieties are, in their turn, usually propagated by means of asexual parts if they are to be kept true.

Practically there is no certainty in hybridization. Rarely can a man picture to himself an ideal variety, and then by means of hybridization produce it. He hybridizes plants which possess some of the characteristics of the desired or ideal variety, and then takes his chances. True plant-breeding sets an ideal, and then reaches it by working along certain definite lines. It seeks first to secure a variation in the desired direction: this may be secured by means of crossing, change of soil, modification of food supply, and other changed conditions. It seeks, then, to preserve or augment the form by means of definite selection.

Fundamentally, there are no laws of hybridization. Every Hybrid is a law unto itself. By the study of many examples of hybridization, one is able to construct an average of probabilities as to what will or what will not occur in a given case: but the given case may contradict all the probabilities without apparent cause. Hybridization is an empirical subject.

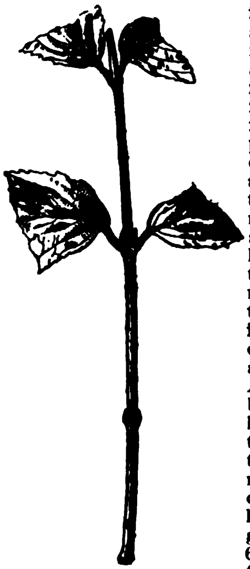
One can not tell what species will or will not hybridize except by trying. Hundreds of species have been tried, and for them the knowledge is more or less exact. Plants hybridize most freely which are the subjects of much care and coddling: the orchids are the best examples. In these groups, Hybrids are chiefly fanciers' plants, valuable often only because they are Hybrids or are rare and curious. One cannot tell beforehand whether the products of any hybridization will be exact intermediates, or in what way or degree they will carry over or blend the parental characters. As a rule, the more closely akin the species, the more perfect will be the blending or amalgamation of the two. See *Pollination*.

The literature of hybridisation is extensive but scattered. The standard text is Focke's "Die Pflanzen-Mischlinge," 1881. The possibilities of hybridization as a factor in plant-breeding are presented in many aspects in the "Hybrid Conference Report" of the Royal Horticultural Society, London, 1900. There are special books devoted to orchid Hybrids (see *Orchids*). In North America there has been little fundamental writing on the subject. See an excellent paper by Swingle and Webber, Year-Book of the U. S. Dept. Agric. 1897; papers in American Gardening, 1899, pp. 397, 413, 431; Bailey's "Plant-Breeding," 1895.

L. H. B.

HYDRÁNGEA (Greek, *hydor*, water, and *aggeion*, vessel; alluding to the cup-shaped fruit). *Saxifragàceæ.* Very ornamental deciduous shrubs, with opposite, simple, rarely lobed, petioled lvs. and small, white, bluish or pinkish fls. in corymbs or panicles, bearing usually marginal sterile fls., with enlarged showy sepals, or in some varieties all the fls. are sterile and enlarged: fr. a small, insignificant capsule. *H. paniculata* is the hardiest of all, but *H. arborescens*, *H. radiata* and *H. Bretschneideri* are also almost hardy North, while *H. quercifolia* and *petiolaris* require at least a very sheltered position and *H. hortensis*, *velutina*, *involucrata* and *virens* are still more tender, and can hardly be grown outdoors North except when well protected and sheltered. They grow best in a rich, porous and somewhat moist soil and thrive well in partly shaded positions, but flower more freely in full sun if they only have sufficient moisture. All Hydrangeas are well adapted for borders of shrubberies, and *H. paniculata* and *hortensis*, especially the varieties with sterile fls., are very showy as single specimens on the lawn. In warmer climates the latter is sometimes used for ornamental hedges (see G.C. III. 24:337 and 456); but it is not hardy in the North. These and also most of the other species should be pruned in fall or early spring, and the branches of the previous year cut back to 1–3 pairs of buds, according to the growth of the branches and the desired size of the panicles; if only slightly pruned the panicles will be many but small. Sometimes they are cut back every year almost to the ground and produce then enormous panicles, which, however, usually need artificial support and lack the gracefulness of less severely pruned plants. *H. paniculata*, var. *grandiflora* can be grown in a small standard tree; for this purpose vigorous young plants should be selected and planted in rich soil, and cut down to the base. The strongest shoot of each plant will attain by fall the height of 4–6 ft., if freely manured and watered during the summer; in autumn, all the weaker branches are cut off, and in colder climates the plants should be lifted and stored in a frost-proof pit or cellar, since the wood is not usually sufficiently ripened to withstand severe frost. In the following year the top of the stem is allowed to branch. The weaker basal shoots may be pegged down to make new plants. Strong-growing varieties of *H. hortensis* may be treated in the same way if standard plants are desired.

H. hortensis, which cannot withstand much more than 10° of frost, is in the North much grown as a pot-plant, especially the more showy varieties with large heads of sterile fls., and is extensively used for outdoor decoration during the summer. Late in fall, when the lvs. have fallen after frost, the plants are moved to a frost-proof cellar and kept rather dry until spring, when they are repotted in new soil and the growth of last year cut back to 1 or 2 pairs of buds. As a suitable soil may be recommended a mixture of loam, leaf-mold and sand, with ground bone, dried cow manure or some other kind of manure added. During the summer a liberal supply of water should be given, also occasionally applications of liquid manure, until the fls. have developed. They may also be planted in the open ground during the summer, lifted late in fall with a large ball of earth, stored over winter in a coldframe or pit and planted out again in spring; this will not injure in any way the profusion of fls. In certain kinds of soil the pink Hortensias show a tendency to turn blue, and perhaps this can be caused by adding iron filings or alum to the soil. *H. hortensis* is also a valuable plant for forcing, and is much grown for Easter, especially the var. *Otaksa*, on account of its dwarfer habit. Handsome pot-plants can be grown in one year from cuttings. In February or March cuttings are inserted in the propagating house with slight bottom heat, and planted in small pots as soon as they are rooted. During the summer they may be easily grown in pots and plunged outdoors in coal ashes or in any kind of porous soil, transplanted several times and freely watered and occasionally manured; or they may be planted out in rich soil, exposed to the full sun, where water should be liberally given and now and then an application of liquid manure. Last of September they should be repotted in 8-inch pots, kept shady some days until established, and afterwards exposed to the sun. After the first frosts they may be brought into a cool greenhouse. If intended to have them in flower for Easter, they should be transferred not later than the fore part of January into a warmer house, with a temperature gradually rising from 50° to 60°; the plants should be freely watered, and about once a week an application of liquid manure given until the flower buds are developed. The fls. should be almost fully developed some time before they are desired, that they may be hardened off in a cooler house, since overforced plants are likely to collapse if exposed to sudden changes of temperature. After flowering, the plants are pruned and repotted or planted out and treated as above described for cuttings, or they may be thrown away and another set of plants raised from cuttings.



1111. Summer cutting of Hydrangea paniculata.

H. petiolaris is a handsome climbing plant for covering walls and trunks of trees, and grows well in the shade, but fls. freely only in the full sun.

The Hydrangeas are readily prop. by cuttings of half-ripened or nearly ripe wood under glass in summer (Fig. 1111); also by hardwood cuttings, layers, suckers or division of older plants. *H. quercifolia* is best propagated by suckers or by layers of growing wood put down in summer. Rarely increased by seeds, which are very small, and should be sown in fall in pans or boxes and only slightly covered with soil.

About 25 species in N. and S. America, Himal. and E. Asia. Lvs. without stipules: fls. perfect in terminal panicles or corymbs, often with sterile marginal fls.; calyx lobes and petals 4–5; stamens usually 10; styles 2–5, short: capsule 2–5-celled, dehiscent at the base of the styles, with many minute seeds.

INDEX.

acuminata, 7 (1).
arborescens, 3.
Azisai, 7 (1).
Belzoni, 7 (1).
Bretschneideri, 6.
Burgeri, 7 (1).
cærulea, 7 (1).
canescens, 4.
cinerea, 4.
cordata, 3.
fimbriata, 7 (3).
floribunda, 1.
glabrescens, 6.
grandiflora, 1.
heteromalla, 5.
Hortensia, 7 (2).
hortensis, 7, 8.
involucrata, 8.
Japonica, 7 (1).
Lindleyi, 7 (1).
macrosepala, 7 (1).
Mandshurica, 7 (2).
Mariesi, 7 (1).
nigra, 7 (2).
nivea, 4.
Otaksa, 7 (2).
paniculata, 1.
Pekinensis, 6.
petiolaris, 9.
præcox, 1.
prolifera, 7 (3).
pubescens, 5.
quercifolia, 2.
radiata, 4.
rosalba, 7 (1).
roseo-marginata, 7.
rubro-plena, 7 (3).
serrata, 7 (1).
stellata, 7 (3).
tardiva, 1.
Thunbergi, 7 (1).
urticifolia, 3.
variegata, 7.
vestita, 6.

A. *Erect or spreading shrubs: stamens 10: petals expanding.*

B. *Inflorescence pyramidal.*

1. **paniculàta**, Sieb. Shrub or small tree, to 30 ft., with dense globose head: lvs. elliptic or ovate, acuminate, serrate, sparingly pubescent above, more densely on the veins beneath, 2–5 in.: panicle 6–12 in. long: fls. whitish, the sterile ones changing later to purplish; styles 3: capsule with the calyx about at the middle. Aug., Sept. Japan. S.Z. 61.—The following varieties are cult.: Var. **floribúnda**, Regel. Panicles large, with more and larger sterile fls. Gt. 16:530. Var. **grandiflòra**, Sieb. (var. *hortensis*, Maxim.). Fig. 1112. Almost all fls. sterile; panicles very large and showy. F.S. 16:1665–66. Gn. 10:37 and 54, p. 376. R.H. 1873:50. Mn. 8:119. A.G. 18:313. Gng. 3:357 and 5:3. F.E. 8:214. S.H. 1:174. Var. **prǽcox**, Rehd. Almost like the type, but flowering about 6 weeks earlier, in the middle of July. G.F. 10:363. The late flowering typical form is sometimes called var. **tardiva**, Hort. *H. paniculata*, var. *grandiflora* is the common Hydrangea of lawns. It is seen to best effect when planted close in front of heavy shrubbery. Cut back rather heavily in early spring.

2. **quercifòlia**, Bartr. Shrub, with spreading branches to 6 ft.: young branches densely ferrugineously tomentose: lvs. long-petioled, roundish or broadly ovate, pinnately lobed with serrate lobes, glabrous above at length, whitish tomentose beneath, 4–8 in. long: panicle 4–7 in. long: fls. pinkish white, the sterile ones turning purple. June. Ky. to Alab. and Fla. B.M. 975. Gng. 2:305. Hardy at Philadelphia.

BB. *Inflorescence corymbose, flat or globular.*

C. *Cyme without involucre at the base.*

D. *Styles usually 2: capsule with the calyx at the apex.*

3. **arboréscens**, Linn. (*H. urticifòlia*, Hort.). Erect shrub, 4–10 ft.: lvs. long-petioled, ovate, acute or acuminate, rounded or cordate at the base, serrate, green and glabrous on both sides or somewhat pubescent or glaucous beneath, 3–6 in. long: cymes 2–5 in. broad, with none or few sterile fls. June, July. N. J. to Iowa, south to Fla. and Mo. B.M. 13:437.—Var. **cordàta**, Torr. & Gr., has the lvs. broadly ovate and cordate.—Var. **stérilis**, Torr. & Gr. Almost all fls. sterile, known also as Hills of Snow.

4. **radiàta**, Walt. (*H. nivea*, Michx.). Similar to the former, but lvs. densely whitish tomentose beneath and cymes always with sterile fls. June, July. N. C. to Mo., south to Ga. B.B. 2:185.—Var. **canéscens**, Dipp. (*H. canescens*, Hort. *H. cinerea*, Small). Lvs. grayish tomentose beneath, sometimes pubescent above. Tenn. to Ga.—Hardy about Philadelphia.

DD. *Styles usually 3: capsule with the calyx near the middle.*

5. **vestìta**, Wall. (*H. heteromálla*, Don. *H. pubéscens*, Decne.). Shrub, to 10 ft.: petiole deeply grooved and margined, red: lvs. ovate, acuminate, densely setosely dentate, almost glabrous above, densely whitish-tomentose beneath, 4–8 in. long: cyme 5–8 in. broad, with bracts; sepals of sterile fls. elliptic or obovate, acute or mucronulate: capsule with the calyx above the middle. June, July. Himal. F.S. 4:378–79. G.C. II. 22:617.

6. **Brétschneideri**, Dipp. (*H. vestìta*, var. *pubéscens*, Maxim. *H. Pekinénsis*, Hort.). Shrub, to 8 ft.: petioles not margined; lvs. ovate or elliptic-ovate to oblong-ovate, acute or acuminate, serrate with short callous teeth, more or less pubescent beneath, 3–5 in. long; cymes similar to the former but smaller and denser, sepals roundish, obtuse: capsule with the calyx near the middle. July. N. China, Setshuen. G.F. 3:17 and 6:396.—Var. **glabréscens**, Rehd. (*H. serrata*, Koehne, not DC.). Lvs. smaller, elliptic, more coarsely serrate and only sparingly pubescent.

7. **horténsis**, Smith (*H. Horténsia*, DC. *H. opuloìdes*, C. Koch. *H. Japónica*, Sieb.). Shrub, to 8 ft., almost glabrous: lvs. ovate or ovate-elliptic, acuminate or acute, coarsely serrate, 5–8 in. long: fls. in large cymes without bracts, white, bluish or pink, few or all of

them sterile.—The greenhouse Hydrangea. June, July, but blooming in winter under glass. A large number of varieties have been introduced from Japan and China, where this species has been extensively cultivated for many centuries, and where it is native. The following are some of the best known. They may be divided into 3 groups:

(1) *Japonica group: cymes flat, with sterile and fertile flowers.*

Var. **acuminàta,** A. Gray (*H. acumindta,* Sieb. & Zucc. *H. Bùrgeri,* Sieb. & Zucc.). Lvs. ovate-lanceolate, acuminate, sparingly appressed-pubescent: sterile fls. with elliptic entire sepals, usually blue. S.Z. 56–57. Var. **Azisai,** Maxim. (*H. Azisai,* Sieb.). Lvs. elliptic-ovate, glabrous: sterile fls. with obovate sepals, long-pedicelled, overtopping the fertile ones. S.Z. 51. Var. **Belzòni, Maxim.** (*H. Belzonii,* Sieb. & Zucc. *H. Japonica,* var. *cærùlea,* Hook. *H. Japonica,* var. *cærulescens,* Regl.). Of dwarfer and stouter habit: lvs. ovate or obovate, short-acuminate, glabrous, somewhat thick: sterile fls. whitish, pinkish or bluish, with rhombic, usually entire sepals. S.Z. 55. B.M. 4253. Here belongs also var. *Impératrice Eugenie* with pink fls. R.H. 1868:471. Var. **Japónica,** Maxim. (*H. Japonica,* Sieb.). Lvs. ovate to elliptic, acuminate, glabrous: sepals broadly ovate, toothed, pink. S.Z. 53. B.R. 30:61. R.H. 1874:90 (as *H. acuminata*). Var. **macrosépala,** Rgl. Differs from the former only by its larger sepals. Gt. 15:520. Var. **Màriesi,** Hort., seems also not much different, but has somewhat broader lvs., and the pink sterile fls. are very large, 3–3½ in. across. Gn. 54:1196. G.C. III. 23, suppl. 5–28. Var. **rosálba,** Van Houtte (*H. Líndleyi,* Hort.). Lvs. ovate or elliptic-ovate, acuminate, sparingly hairy: sepals dentate, ovate or broadly ovate, white and pink or white changing to pink. S.S. 16:1649–50. R.H. 1866:430. Gn. 46:990. Var. **serràta,** Rehd. (*H. serrata,* DC. *H. Thùnbergi,* Sieb. & Zucc. *H. cyanea,* Hort.). Lvs. elliptic or ovate, narrowed at both ends, serrate, sparingly appressed-hairy, 1½–3 in. long: cymes small, 3–4 in. broad: fls. pinkish or bluish; sepals roundish, obtuse or emarginate. S.Z. 58. G.C. 1870:1699.

(2) *Hortensia group: cymes globose, with almost all fls. sterile.*

Var. **nigra,** Arb. Kew. (*H. Mandshúrica,* Koehne. *H. opuloìdes,* var. *cyanóclada,* Dipp. *H. nigra,* Carr. *H. ramulis coccineis* and *ram. pictis,* Hort.). Branches dark purple or violet, often almost black: lvs. ovate-elliptic, acute: cymes large, with purple peduncles: sepals pink or bluish, obovate. A.F. 5:360. Var. **Horténsia, Maxim.** Lvs. large, elliptic, glabrous: sepals broadly ovate, entire, usually pink. This is the form which first came into cultivation outside of Japan and China, and is said to have been introduced from China to England in 1790, by Joseph Banks. B.M. 438. G.C. III. 24:45. Gn. 45, p. 12; 50, pp. 123, 256, 367; 52:281. Var. **Otáksa, Maxim.** (*H. Otaksa,* Sieb. & Zucc.). Fig. 1113. Dwarfer, but of vigorous growth: lvs. obovate, short-acuminate, rather thick, glabrous: sepals obovate, entire, pink or blue. S.Z. 52. F.S. 17:1732–33. Gn. 50:1079. R.H. 1868:450. Mn. 5, p. 105. A.G. 11:415. A.F. 10:1015. F.E. 9:52 and 401. Gng. 5:161. Var. **plèna,** Rgl. Similar to var. *Hortensia,* but sepals toothed. Var. **Thomas Hogg,** Hort. Lvs. elliptic or ovate, rather small: heads large, pure white. This variety is somewhat dwarfer than the common Hydrangea and is, besides Otaksa, the best as a pot-plant. It is also to be recommended for outdoor cultivation, as it is one of the hardiest.

1112. Hydrangea paniculata, var. grandiflora.

1113. Hydrangea hortensis, var. Otaksa.

(3) *Stellata group: fls. with many narrow sepals.*

Var. **stellàta,** Maxim. (*H. stellàta,* Sieb. & Zucc.). Lvs. ovate or ovate-oblong, sparingly pubescent: cymes with larger sterile and smaller fertile fls., both with many narrow-elliptic sepals. S.Z. 59. Var. **fimbriàta,** Dipp. Cymes rather dense, with almost all the fls. sterile: sepals fimbriate, white, pink toward the base. G.C. III. 23, suppl. 5:28. Var. **prolifera,** Hort. (*H. stellata,* var. *prolifera,* Rgl.). The fertile fls. bearing 1 or few smaller ones in the center. Var. **rubro-plèna,** Dipp. Cymes rather dense, with almost all fls. sterile, changing from pink or pale lilac to dark red.

There are also some varieties with variegated lvs., as var. **variegàta,** Regel, a form of var. *Belzoni,* with the lvs. edged white (F.S. 7:696); var. **tricolor,** Hort., with the lvs. variegated with white and edged yellow; var. róseo-**marginàta,** Hort., with the lvs. spotted white and edged pink.

CC. *Cyme enclosed before expanding by 6-8 large, deciduous bracts.*

8. **involucràta,** Sieb. Low shrub, to 5 ft.: lvs. oblong, acuminate, densely and sharply serrate, appressed, pubescent on both sides, rough to the touch, 4–8 in. long: bracts at the base of the cyme large, orbicular; smaller bracts none: fertile fls. blue or pinkish, sterile ones whitish: capsule with the calyx at the apex; styles usually 2. Aug. Jap. S.Z. 63. J.H. III. 32:103. *H. Sapphire,* introduced 1890 by Lovett, seems to belong here. Var. **horténsis,** Maxim. Fls. double, usually pink and often proliferous. S.Z. 64. F.S. 3:187.

AA. *Climbing by aërial rootlets: stamens 15: petals cap-like, cohering, falling off as a whole.*

9. **petiolàris,** Sieb. & Zucc. (*H. scándens,* Maxim., not DC. *H. volùbilis,* Hort.). Climb-

ing to 80 ft. in Japan: lvs. long-petioled, broadly ovate-cordate to elliptic, acute or acuminate, crenately serrate, almost glabrous, 2–4 in. long: cymes rather loose, –810 in. across, with rather few sterile fls.; styles usually 2: capsule with the calyx at the apex. July. Japan, Saechalin. B. M. 6788. S. Z. 54, 59, 2, 92. M. D. G. 1897:236–37. S.H. 2:191–93.—A very variable species, figured and described by Sieb. & Zucc. under three different names. In gardens it is often met with under the name of *Schizophragma hydrangeoides*, another Japanese climber of similar habit, which, however, is easily distinguished by its sinuately dentate lvs. and its sterile fls. having only one large cordate sepal.

H. altissima, Wall. Allied to H. petiolaris, but less high climbing, often only a spreading shrub, to 15 ft.: lvs. ovate-lanceolate: stamens 10. Himal.—*H. áspera*, Don. Shrub, to 20 ft., similar to H. vestita: lvs. oblong-lanceolate, densely pubescent beneath: sepals usually toothed: fr. with the calyx at the apex. Himal. Tender.—*H. hírta*, Sieb. & Zucc. Shrub, to 4 ft.: lvs. broad-elliptic, coarsely incised-serrate: cymes without sterile fls. Jap. S.Z. 62. Not very decorative.—*H. robústa*, Hook. f. & Thoms. (H. cyanema, Nutt.). Spreading shrub, to 15 ft., with large ovate lvs., pubescent on both sides; sterile fls. with toothed sepals: capsule with the calyx at the apex. Himal. B.M. 5038. Handsome in bloom, but tender.—*H. virens*, Sieb. Slender shrub, to 6 ft.: lvs. elliptic or lanceolate, coarsely serrate, 1–2½ in.: cymes rather few-fld., sterile fls. with 3 or 4 large, unequal sepals, white. Jap. S.Z. 60. A desirable shrub, with graceful and delicate fls. and with the lvs. often handsomely variegated along the veins, but tender.

Alfred Rehder.

HYDRÁSTIS (name of doubtful meaning). *Ranunculàceæ.* Two species of hardy herbaceous perennials, one from Japan and one from N. Amer. Stem erect, pubescent: lvs. palmately 5–7-lobed, serrate: fls. greenish white, small, solitary; sepals 3, petal-like, falling early; petals none; stamens many; carpels 2-ovuled, in fruit becoming aggregated berries. Requires moist situations in good, rich loam and leaf-mold. Prop. by division of the root, and by seed.

Canadénsis, Linn. Orange Root. Golden-seal. Stem 4–10 in. long, from a thick, yellow rootstock: basal lvs. 5–8 in. broad; stem lvs. 2, lower one petioled, upper sessile and near the small flower: fr. in ovoid head, the 8–12 fleshy carpels tipped with a short, curved beak. April. Eastern U. S., in rich woods. B.M. 3019 (in flower); 3232 (in fruit).—Used in gardens for the showy leaves and beautiful red fruit; root used in medicine.

K. C. Davis.

HYDRIASTÈLE (Greek, *water* and *column;* the tall trunks growing near springs). *Palmàceæ.* A genus of one species, a tropical Australian palm advertised by perhaps only one American dealer as *Kentia Wendlandiana.* It is told, however, from the Kentias in foliage by the leaf-segments split at the apex instead of acuminate and not split. More fundamentally, it differs in having the ovule on the side of the cell instead of at the bottom, as in Kentia. In this respect it agrees with the group of genera mentioned under Hedyscepe, but it differs from that group in having the fls. borne in 4 ranks instead of spirally. Hydriastele is a spineless palm with erect winged caudex: lvs. terminal, pinnatisect; segments alternate, linear, split at the apex; midveins covered below with caducous scales; margins thin; rachis laterally compressed, dorsally convex; face of the petiole concave; sheath rather short: spadices with short, wide peduncles, branched from the base, the branches obtusely quadrate, long, slender, pendulous: spathes 2, complete, compressed, deciduous, the lower one ancipital: bracts and bractlets connate; fruit small, ellipsoidal, smooth or ribbed. For culture, see *Palms.*

Wendlandiàna, H. Wendl. & Drude (*Kéntia Wendlandiàna*, F. Muell.). A tall palm. Leaves many feet long; segments numerous, unequal, the longest 1½ ft., the upper ones confluent at the base, all denticulate at the apex. Queensland.

Jared G. Smith.

This distinct and excellent palm has hitherto been rare, but now that the seeds are being produced in tropical nurseries it is fast becoming popular. The seeds are round, fairly hard, and resemble those of *Archontophœnix Alexandræ.* The characteristic lvs. are pinnatifid, the segments being irregular and somewhat jagged at the apex, after the fashion of a Fish Tail palm or Caryota. It stands the temperature of an ordinary living room better than many other palms. For rapid growth it needs more heat than *Howea Belmoreana* and *Forsteriana.* In the greenhouse a temperature of 60 to 70° is most congenial. A lower temperature will not hurt it, but gives a slower and more compact growth. It loves plenty of moisture, and frequent syringing is beneficial. For potting soil, it likes rich loam, with plenty of sharp sand and good drainage. The seeds and seedlings should be treated more like the commercial Areca, i.e., *Chrysalidocarpus lutescens.* It forms a single stem when only 3 ft. high, and grows to a height of 20 ft. or more in cult. It is at its best when 10 to 15 ft. high. When well established and pot-bound it loves high feeding, as does *Chrysalidocarpus lutescens.* This palm has a bright future commercially.

H. A. Siebrecht.

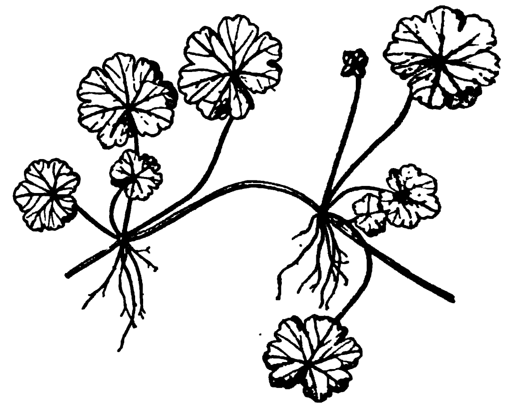
HYDRÓCHARIS (Greek, *graceful water plant*). *Hydrocharidàceæ.* Frogbit. A genus of one species, an aquatic plant, grown in a few aquaria. It is found in ditches and ponds in Europe and temperate Asia. **H. Morsus-rànæ**, Linn., has floating stems resembling runners, and tufts of radical leaves, and submerged roots. Lvs. stalked, roundish, with a heart-shaped base, rather thick, about 2 in. across: peduncles of the staminate plant bearing 2–3 fls. on long pedicels, which spring from a spathe of 2 thin bracts: petals 3, white, stamens 3–12: spathe of the pistillate fls. sessile among the lvs.: styles 6, with 2-cleft stigmas. For American Frogbit, see *Limnobium.*

Hydrocharis dies in the fall, but winter buds (see similar buds of Elodea, Fig. 759) break off and sink when the old plants die. In spring, or in the greenhouse or aquarium under genial conditions, they start early into growth, the scales bursting and a young leaf developing and then the whole rises to the surface. It is a very interesting plant. Its fine, silky roots are beautiful and attractive in the aquarium, as well as the soft, tender leaves and delicate flowers.

Wm. Tricker.

HYDRÓCLEYS. See *Limnocharis.*

HYDROCÓTYLE (Greek, *water* and *beaker;* the plants thrive in moist places, and the roundish lvs. have a cup-like depression in the middle). *Umbelliferæ.* This includes a plant which, according to J. N. Rose, is considerably used at Washington, D.C., for carpet bedding under the name of *H. sibthorpioides*, but, like many other bedding plants its name seems not to appear in the leading retail catalogues, American or foreign. Fig 1114 is the only accessible picture of the plant, except that in Hooker's Exotic Flora as *H. nitidula.* The plant has shining lvs. ¼–1 in. across, and is perhaps perennial. It is prostrate and roots at the nodes. The genus contains about 70 widely scattered species, mostly inhabiting swamps, and has no near allies of garden value. The species vary widely in habit and otherwise.



1114. Hydrocotyle rotundifolia (× ⅓).

important generic characters are fr. strongly compressed: calyx teeth minute or obsolete; petals concave, valvate or imbricate: umbels simple. For culture, see *Bedding.*

rotundifòlia, Roxb. (*H. sibthorpioides*, Lem. *Sibthórpia Europæa*, Hort., not Linn.). Fig. 1114. Lvs. orbicular, cordate, subentire or 7–9-lobed to the middle or lower, doubly crenate: umbel 6–8-fld.: fr. 2-ribbed. Trop. Asia and Afr. Numerous synonyms are accounted for by the variable length of the petiole. W. M.

HYDROPHÝLLUM (Greek, *water-leaf;* application obscure). *Hydrophyllàceæ.* About 7 species of American hardy herbaceous plants, mostly North American, and perennial, with pinnate or palmately cut foliage and cymose clusters of numerous small white, lilac, light blue, purplish or violet fls. borne in early summer. These plants grow a foot or two high, and are desirable for shady situations where other plants do not succeed. They are obtainable from dealers in native plants and collectors. Floral parts in 5's: ovary 2-celled: styles 2. Important generic characters are: calyx appendaged or not: corolla bell-shaped, the tube within bearing a linear, longitudinal appendage opposite each lobe, with infolded edges, forming a nectariferous groove.

A. *Calyx appendaged with a reflexed lobe at each sinus.*

appendiculàtum, Michx. Biennial (all the others perennial), hirsute with long spreading hairs: root-lvs. pinnately 5–7-parted: stem-lvs. palmately 5–7-angulated-lobed: fls. violet or purple. B.B. 3:44.

AA. *Calyx not prominently appendaged (often minutely appendaged in H. Canadense).*

B. *Lvs. palmately cut.*

Canadénse, Linn. Fls. mostly greenish white: sometimes purplish. B.R. 3:242. B.B. 3:44.

BB. *Lvs. pinnately cut.*

C. *Peduncle shorter than the petioles.*

capitàtum, Dougl. Tufted, about 9 in. high: lvs. softly hirsute or pubescent. This and the next are the only 2 far western species.

CC. *Peduncle longer than the petioles.*

D. *Divisions of the leaf 7–15.*

occidentàle, Gray. Pubescent, hirsute or sparingly hispid: fls. violet-purple, varying to white: 1 ft. or more.

DD. *Divisions of the leaf 3–5.*

Virgínicum, Linn. Glabrous or nearly so: fls. white or violet-purple. B.B. 3:43.

HYDROTǼNIA (Greek, *water* and *band;* referring to a triangular glandular bar which secretes nectar). *Iridàceæ.* Four species of tender bulbs from Mexico and Peru, more curious than beautiful, allied to Tigridia, which see for culture. The following is procurable from Dutch bulb growers.

Van-Hoúttei, Baker. Stem 2–3 ft. long, bearing 2–3 fls.: lvs. lanceolate, plaited, the lower 1 ft. long: spathes inflated, 2 in. long: perianth campanulate; outer segments oblong, over 1 in. long, greenish outside, inside dark brown, much veined, yellowish at tip; inner segments suborbicular, half as long, pale lilac, somewhat veined. F.S. 21:2174, as *Tigridia Houttei.*

HYMENǼA (application obscure). *Leguminòsæ.* This includes a tree cult. in S. Calif. for its economic interest. According to Von Mueller, the timber is hard, extremely heavy, close-grained, used for select wheelwork, treenails, beams, planks, and in various machinery. A fragrant, amber-like resin, known as West Indian copal, exudes from the stem. A tree of colossal size and remarkable longevity, found in the West Indies, Trop. Amer. and subtropical S. Amer. A genus of 8 species of tropical American trees: lfts. 2, leathery, said to close at night: fls. white, in short, densely corymbose panicles; sepals 4; petals 5, sessile; stamens 10: stigma small: pod short, indehiscent, woody.

Courbaril, Linn. Lfts. unequal-sided, obliquely oblong-lanceolate: fls. pedicellate: pod few-seeded, filled with an edible mealy pulp with a honey-like taste.

HYMENOCÁLLIS (*beautiful membrane*, alluding to the webbed filaments). Including *Ismene. Amaryllidàceæ.* SPIDER LILY. SEA DAFFODIL. Bulbous plants of about 30 species of the warm parts of the New World (one in Africa), cult. for the fragrant white (in 1 species yellow), umbellate fls. Perianth with a cylindrical tube, equal linear or lanceolate segments: stamens 6, the filaments free above but webbed and united into a cup below, the anthers narrow and versatile: ovary 3-loculed, with 2 ovules in each, bearing a long, slender style and capitate stigma: scape solid and compressed, arising from a tunicated bulb: lvs. oblong or strap-shape. The genus is represented in the Old World by Pancratium, which differs chiefly in having many ovules in each locule. For an account of the species, see Baker, Amaryllideæ, pp. 120–129 (1888).

Some of the species of Hymenocallis are winter bloomers: these should be treated essentially like Crinums, being rested or kept slow in the summer. They require a warm temperature. Of such are *H. macrostephana, H. speciosa, H. Caribæa.* Other species require an intermediate or conservatory temperature, and bloom in spring or summer, resting in winter. Of such are *H. calathina, H. Harrisiana, H. Macleana, H. lacera, H. littoralis.* Some of these latter or intermediate-house species are hardy in the southern states, there blooming in spring, as *H. lacera, H. Galvestonensis,* and others. The species of Hymenocallis require no special treatment (see *Bulbs*), except that the same bulbs may be flowered year after year if they receive good care. Use turfy or peaty soil that will not become "sour" or soggy. Prop. by offsets from the bulbs.

INDEX.

calathina, 12.
Caribæa, 7.
declinatum, 7.
Galvestonensis, 8.
Guianense, 1.
Harrisiana, 6.
lacera, 9.
littoralis, 4.
Macleana, 11.
macrostephana, 10.
rotata, 9.
Senegambica, 5.
speciosa, 3.
tubiflora, 1.

A. *Filaments long and slender beyond the small cup.*

B. *Lvs. distinctly petioled.*

1. **tubiflòra**, Salisb. Bulb ovoid, about 4 in. in diam., short-necked: leaf-blade about a foot long and one-third to one-half as broad at the middle, the petiole 6–12 in. long: scape 1 ft. tall: fls. many in the umbel and sessile, the valves or bracts broad and cuspidate: tube of perianth greenish, 6–8 in. long, the linear white reflexing segments 4 in. long: cup 1 in. long, not toothed, less than half or a third the length of the free part of the filament. Northeastern S. Amer. B.R. 4:265, as *Pancratium Guianense*, Ker.

2. **undulàta**, Herb. Bulb ovoid, 3–4 in. in diam.: lvs. with an oblong blade 1 ft. long and half as wide, cross-veined: scape 2 ft. long, compressed: fls. about 10, sessile, the tube 6–7 in. long, and the segments 3–4 in. long and linear, white, with tinged red cup an inch long. Venezuela.

3. **speciòsa**, Salisb. Bulb globular, 3–4 in. in diam.: lvs. 20 or less, large (often 2 ft. long), oblanceolate-oblong and acute, narrowed into a channelled petiole: scape mostly shorter than the foliage, glaucous: fls. 10–15, on very short pedicels, the bracts or spathe-valves 3–4 in. long: tube of perianth greenish, 3–4 in. long, the segments often twice longer (entire fl. often 9 in. long): cup about 1¼ in. long, toothed, the free parts of the filaments little longer than the cup. W. Indies. B.M. 1453. Gn. 47, p, 294. F. 1883, p. 71.—One of the best. The bulb improves with age if care is taken in growing and repotting. The lvs. are evergreen and handsome. Fls. very fragrant, retaining their scent even when dried. Blooms in winter. This and *H. macrostephana* are the most showy species.

B. *Lvs. not petioled, strap-shaped.*

C. *Perianth tube mostly above 3 in. long.*

4. **littoràlis**, Salisb. Bulb 3–4 in. in diam.: lvs. about 12, 2–3 ft. long, 1½ in. broad, acute: scape 2-edged, 2 ft. or less tall: fls. 4–8 in a sessile umbel, the tube 6–7 in. long and green-tinged, the segments linear and recurved, 4 in. long, joined to the base of the cup: the cup funnel-shape, broader and longer, toothed, the free part of the

filaments about 2–3 in. long: style about equaling the stamens. Tropics. Gn. 53, p. 57.—Long known in cult., but less showy than other species.

5. **Senegámbica,** Kunth & Bouché. Lvs. somewhat curved, acute, 2 ft. long, 2 in. broad at the widest place: scape about as long as the lvs.: fls. 6–8 in a sessile umbel, the tube 5–6 in. long, segments very narrow and 4 in. long: cup funnel-shaped, 1 in. long and somewhat broader, the free parts of the filaments 2 in. long. W. Africa.

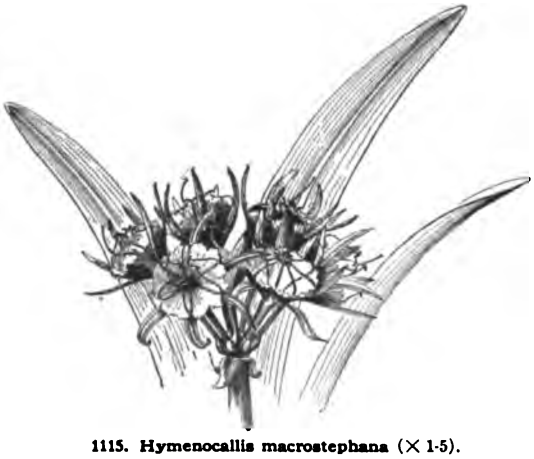
6. **Harrisiàna,** Herb. Bulb globular, small (less than 2 in. in diam.): lvs. only 3–6, a foot long and 2 in. broad, much narrowed below: scape less than 1 ft. tall, slender, glaucous: fls. 2–3 in a sessile umbel, the tube slender and 3–4 in. long, the segments linear and 3 in. or less long: cup funnel-shaped, ¾ in. long, plicate, small-toothed, the free filaments 1½ in. long and often exceeding the style. Mex. B.M. 6562.—Flowers in early summer. Hardy South.

CC. *Perianth tube mostly under 3 in. long.*

7. **Caribæa,** Herb. (*Pancràtium Caribæum*, Linn. *P. declinàtum*, Jacq.). Bulb globular, 3–4 in. in diam.: lvs. thin, 12 or more, not 2-ranked, shining, 2–3 ft. long, 2–3 in. broad at the widest place: scape sharp-angled, nearly or quite as long as the lvs.: umbel sessile, 6–12-fld.: tube 2–3 in. long, the segments linear and somewhat exceeding it: cup 1 in. long, toothed, the free part of the filaments 1½–2 in. long. W. Indies. B.M. 826. L. B.C. 6:558.

8. **Galvestonénsis,** Baker. Scape 1–2 ft. long, rather shorter than the linear lvs.: umbel sessile, 4–6: perianth tube 2–3 in. long (sometimes shorter), mostly a little shorter than the linear segments: cup 1¼ in. or less long, funnel-shape, the edge erect, the free part of the filaments little more than ½ in. long. Texas.—Lately introduced to cultivation with the statement that it "may be planted out in gardens all over the North like a peony and prove hardy." Spring or early summer.

9. **lácera,** Salisb. (*H. rotàta*, Herb. *Pancràtium rotàtum*, Ker). Bulb ovoid, 2 in. or less in diam., with a long neck and producing stolons or runners: lvs. 6–8, linear, 1½ ft. or less long, flat above but concave toward the base: scape 2-edged, glaucous, about as long as the lvs.: umbel sessile, with 2–6 fls.: tube green, 3–4 in. long, exceeded by the linear, often recurved lobes: cup saucer-shaped or rotate, irregularly toothed, the free part of the filaments 1½ in. long. N. Car. to Fla. B.M. 827. L.B.C. 1:19.—Variable, particularly in the dimensions of the fl. Spring or early summer.



1115. Hymenocallis macrostephana (× 1-5).

10. **macrostéphana,** Baker. Fig. 1115. Closely allied to *H. speciosa*, and conjectured by Baker to be a hybrid of that species and *H. calathina*. Bulb with a long neck: lvs. 8–9, oblanceolate and bright green, 2–3 ft. long: fls. 6–10, large and striking because of the great cup (whence the specific name), which is 2 in. across and as much long, wavy-toothed: tube greenish, 3 in. long: segments linear-lanceolate, a little longer than the tube. B.M. 6436. Gn. 18:211.—Blooms in Feb. and Mar. One of the best of the Spider Lilies, perhaps the best for warm-house culture.

AA. *Filaments short and incurved (usually less than 1 in. long) beyond the large cup. (Ismène.)*

11. **Macleàna,** Nichols. (*Ismène Macleàna*, Herb.). Bulb ovoid, 2 in. in diam.: lvs. a foot or more long and nearly 2 in. broad, narrowing towards the base: scape 2-edged, about the length of the lvs.: fls. 2–8, with a straight tube 2 in. or less long, and linear, erect or somewhat spreading segments as long as the tube: cup corolla-like, 1½ in. long and green-striped, fringed, the free filaments ½ in. long, strongly inflexed and angled or kneed at the cup. Peru. B.M. 3675.—One of the plants known to the Peruvians as Amancæs, the subject of festivals. This and the next are intermediate-house species, flowering in spring and summer.

12. **calathina,** Nichols. (*Ismène calathìna*, Herb. *Pancràtium calathìnum*, Ker). Bulb long-necked: lvs. 6–8, somewhat 2-ranked, strap-shaped, 2 ft. or less long: scape 2-edged, 1½ to 2 ft. tall, bearing 2–5 fls. in a sessile umbel: tube green, 3–4 in. long, much enlarging above: segments as long as the tube, ½ in. wide, lanceolate: cup corolla-like and green-striped, usually larger than in the last, with rounded fringed lobes: filaments free for ½ in., incurved but not angled. Peru, Bolivia. B.M. 2685.

The following names may be expected in the trade: *H adnàta*, Herb.=H. littoralis.—*H. Amáncæs*, Nichols., is one of the Ismene group, and the only species with yellow fls. B.M. 1224. B.R. 7:600. Gn. 48, p. 168.—*H. amœna*, Herb.=H. ovata (below).—*H. Andreàna*, Nichols. An Ismene: fl. only 1, the cup nearly or quite as long as the segments. R.H. 1884, p. 129. 468.—*H. crassifòlia*, Herb. (H. occidentalis, Britton & Brown) Ga. to Mo.: lvs. linear, evergreen, thick: fls. with tube 3–5 in long and linear segments nearly as long: cup much narrowed below.—*H. fràgrans*, Salisb.=H. ovata (below).—*H. Moritziàna*, Kunth. Evergreen, with lvs. like Eucharis: fls. white, fragrant, with greenish tubes, very slender and twice as long as the segments, the cup very short and toothed. Venezuela. G.C. III. 27:89.—*H. ovàta*, Roem. Lvs. broad and petioled: fls 6–10, the tube about 2 in. long, the linear segments little longer: cup 1 in. long. W. Indies. B.R. 1:43. B.M. 1467. L. H. B.

HYMENÒDIUM. See *Acrostichum.*

HYMENÓLEPIS. See *Acrostichum*

HYMENOPHÝLLUM (Greek, *membrane-leaved*). *Hymenophyllàceæ.* A large genus of filmy ferns allied to Trichomanes, but having a more or less deeply 2-lipped or 2-valved involucre. Some 80 species are found in the tropics of both hemispheres. One species appears in wells in England.

Hymenophyllum demissum is a difficult plant to grow. It needs a Wardian case in a coolhouse, and occasional sprinkling overhead. The members of this genus are propagated slowly by division.

A. *Lvs. glabrous: rachis slightly winged above.*

polyánthos, Swz. Lvs. 2–8 in. long, 1–3 in. wide, tripinnatifid: sori 2–12 to a pinna; involucre small. Tropics of both hemispheres.

demíssum, Swz. Lvs. 4–12 in. long, 3–4 in. wide, 3–4-pinnatifid; sori very numerous, 20–30 to a pinna; involucre with ovate entire valves. E. Indies to New Zealand.

AA. *Lvs. pubescent or ciliate.*

ciliàtum, Swz. Fig. 1116. Stalks ciliated and winged above: lvs. 2–6 in. long, 1–2 in. wide, tripinnatifid, the segments ciliated; involucre roundish, the valves divided half way down and ciliated. Tropics of both hemispheres.

æruginòsum, Carm. Fig. 1117. Stalks tomentose: lvs 2–3 in. long, 1 in. or less wide, tripinnatifid, the pinnæ often imbricate, the surface and margins densely pubescent; involucres small, with valves divided nearly to the base, densely ciliate. Tristan d'Acunha.

L. M. UNDERWOOD and ROBERT SHORE.

HYMENÓSPORUM (Greek, referring to the 2-winged seeds which distinguish it from Pittosporum). *Pittosporàceæ.* This includes an ornamental shrub, cult. only in S. Calif. It has corymbs of tubular yellow fls. each 1 in. or more across. The genus has only one species, an evergreen Australian shrub, with the habit of Pittosporum and resembling that genus in having thick, leathery capsules and an indefinite number of seeds, but in Pittosporum the seeds are thicker, not so much flattened and not winged.

flàvum, F. Muell. Lvs. usually alternate, sometimes opposite or subverticillate, becoming nearly 9 in. long, obovate, leathery, entire: corolla with 5 obovate lobes, silky outside, marked with red at the throat; stamens 5. B.M. 4799.

HYMENÓXYS Califórnica is *Actinolepis coronaria*

1116. Hymenophyllum ciliatum. (×½.)

1117. Hymenophyllum æruginosum. Nat. size.

HYOPHÓRBE (Greek, *food for swine;* referring to the fruits, probably). *Palmàceæ.* Three species of pinnate palms from Mauritius, 2 of which are cult. under glass North and outdoors South. Much of their distinctive beauty is in the color of the petiole and rachis, which in *H. Verschaffeltii* is yellow, while in *H. amaricaulis* the petiole is maroon and the rachis orange. The first species also has its leaves handsomely veined with white.

These two species are highly ornamental palms, and are frequently found in trade collections. They would probably be grown in greater quantities were it not for the fact that they are not very rapid growers while in a young state. They are naturally heat-loving plants, and flourish under similar treatment to that recommended for the palm commercially known as *Areca lutescens,* namely, a good loamy soil well enriched with stable manure and with a moderate addition of bone dust, firm potting, an abundance of water, and a night temperature of 65°, while in common with palms in general when grown under glass, it is found necessary to shade from full sunshine during the period between March 1 and November 1.

Of the two species, *H. Verschaffeltii* is much the better, and is one that should be found in all collections, its stout and usually triangular stem and well furnished foliage giving it a distinction that readily attracts attention. Seeds of Hyophorbe should be sown in a light compost, pure peat giving good results for this purpose, the seed pots being placed in a bottom heat of 80° and kept moist. The seedlings are delicate in their earlier stages, and should be kept in a warm place until thoroughly established; they also require careful watering, the roots of these small plants being quite tender.

Hyophorbe is allied to Chamædorea and Roscheria, which are cultivated. Hyophorbe is spineless and the leaf segments are acuminate, while Roscheria has spines and segments 2-cut at the apex. In Hyophorbe the fls. are monœcious in the same spadix and disposed in small, elongated heaps: in Chamædorea the fls. are diœcious or monœcious in different spadices and spirally disposed. Hyophorbe contains stout, spineless palms with ringed caudices, cylindrical, or swollen below the middle or interruptedly swollen: lvs. terminal, equally pinnatisect, the subopposite segments linear-lanceolate, acuminate, plicate-nerved, with the thickened margins recurved at the base; petiole subcylindrical, the upper surface slightly furrowed, 3-sided at the base; sheath large, swollen, entire: spadices with short peduncles, twice-branched, the branches slender, spreading; spathes numerous, imbricated in 2 rows: fls. pale green or yellow: fr. small, pear-shaped or olive-shaped, straight or curved, gibbous or bigibbous at the base, orange or blue.

amaricaùlis, Mart. (*Arèca speciòsa,* Hort.). Palm 60 ft. high, with a bottle-shaped caudex, 15–24 in. in diam. near the base, slightly diminishing upwards to the base of the leaf-sheaths and there abruptly constricted: petiole 12–18 in. long, somewhat trigonous, grooved on the face; segments in 40–60 pairs, 18 in. long, 2 in. broad, with the central and 1 lateral vein on each side prominent above, the veins clothed below with rather rigid, lanceolate, appressed scales. I.H. 13:462. —Mauritius.

Verschafféltii, H. Wendl. (*Arèca Verschafféltii,* Hort.). Caudex 25–30 ft. high, 6–12 in. in diam. at the base, bulging after a few feet, reaching 12–24 in. in diam. in the middle, thence contracting upward: petiole 3 in. long, subterete, slightly grooved on the upper surface, with a yellow band extending from the upper part of the leaf-sheath along the face of the petiole to the base of the blade; segments in 30–50 pairs, 20–30 in. long, 1 in. wide, only the central vein prominent, clothed on the under surface toward the base with short, linear scales. Mauritius. I.H. 13:462. G.C. 1870:418.

H. Commersoniàna, Índica and *lutéscens* are Chrysalidocarpus lutescens, though H. Indica is given as a good species by Index Kewensis. JARED G. SMITH and W. H. TAPLIN.

HYOSCÝAMUS (Greek, *hog's bean*). *Solanàceæ.* HENBANE is a coarse, clammy, ill-smelling, annual or biennial wayside weed which is cultivated for medicinal purposes. An extract is commonly sold in drug stores. About 15 species of herbs, biennial or perennial, pilose or glabrous: lvs. wavy-margined, coarsely toothed, or pinnatifid, rarely entire: corolla pallid, or lurid and netted-veined, funnel-shaped, with 5 unequal lobes: capsule circumscissile above the middle. The nearest ally of garden value is Datura. Henbane grows wild in Eu., W. Asia and Himalayas and is naturalized in Amer. It is found in sandy and waste places. Seeds can be obtained by the pound or less. For medicinal purposes, only the leaves of the second year's growth should be used.

niger, Linn. Annual or biennial, 1–2½ ft. high: lvs. 3–7 in. long, the upper ones ~~stem-clasping, irregularly~~ lobed or pinnatifid: ~~fls.~~ greenish yellow, with purple veins. June–Sept. B.B. 3:138.

HYPÉRICUM (old Greek name of obscure meaning used by Dioscorides). *Hypericàceæ.* ST. JOHN'S-WORT. A genus of about 200 species, consisting of herbs, under-shrubs and shrubs, and scattered over the whole world, but particularly abundant in S. Europe, W. Asia and N. Amer.; few species of any value in the garden. The leaves are opposite, oblong or lanceolate, exstipular, sessile or subsessile, entire, subevergreen or deciduous, dotted with pellucid or opaque glands, rich in volatile oil. Flowers polypetalous, terminal, solitary or disposed in single or compound cymes, appearing July–Oct., but particularly in early August; sepals 4–5, more or less united at the base and unequal; petals commonly yellow, 4–5, oblique or contorted, hypogynous, alternate with the calyx; stamens numerous, free or connate, in

3–5 clusters, sometimes with interposed hypogynous glands: ovary free, 1-celled, with a central placenta or incompletely or completely 3–5-celled, sometimes longitudinally furrowed: fr. a berry or capsule, with numerous seeds borne upon the placenta or introflexed margins of the carpels: styles 3–5, free or united, persistent.

The Hypericums grow 6 in. to 5 ft. high, of erect to prostrate habit, most of them tender or of uncertain hardiness, requiring some winter protection. Many kinds from the southern United States and southern Europe, otherwise good, are unreliable from lack of hardiness. Several N. American species not yet in cultivation are ornamental and hardy. The few useful species furnish a brilliant color, blooming when most shrubs do not. All are of simple culture, succeeding in almost any garden soil, but generally preferring a light, warm land; hence useful in sandy soils, flowering later and longer if partly shaded. They are prop. by seeds, suckers, cuttings and strong pieces of creeping-rooted kinds. The twigs are terete, 2-angled or 4-angled. The smaller species are useful as rock-plants, the larger as border plants, in the front of shrubberies or in unmixed masses. Their common name, St. John's-Wort, comes from the fact that the common people of some European nations used to gather the flowers of *H. perforatum* to decorate their dwellings on St. John's Day. The Hypericums are mostly short-lived, and need renewal every 6–7 years.

INDEX.

adpressum, 9.
Androsæmum, 8.
Ascyron, 1.
aureum, 20.
axillare, 14.
Buckleyi, 10.
calycinum, 5.
Chinense, 23.
cistifolium, 21.
densiflorum, 13.
elatum, 17.
elegans, 11.
fastigiatum, 9.
floribundum, 18.
foliosum, 22.
gladioides, 14.
hircinum, 16.
Hookerianum, 2.
Japonicum, 12.
Kalmianum, 6, 22.
lobocarpum, 7.
monogynum, 23.
Moserianum, 4.
multiflorum, 19.
Nepalense, 3.
nudiflorum, 21.
oblongifolium, 2.
patulum, 3.
prolificum, 22.
pyramidatum, 1.
salicifolium, 23.
sphærocarpon, 15.
tricolor, 4.
triflorum, 2.
Uralum, 3.
Virginicum, 24.

A. *Flowers yellow.*

B. *Styles 5.*

C. *Plant herbaceous.*

1. **Áscyron**, Linn. (*H. pyramidàtum*, Dryand.). Upright perennial, 2–6 ft. high, with tetragonal stems: lvs. clasping, ovate-oblong or ovate-lanceolate, acuminate from the base, 2–5 in. long: cymes terminal, 3–12-fld., appearing in July: fls. 1–2 in. in diam.; sepals small, ovate-lanceolate; petals thin, narrowly obovate or oblanceolate, curiously shaped and twisted, persistent until withered; stamens in 5 clusters; styles somewhat spreading; stigmas capitate: capsule ovoid, ¾ in. long. —A somewhat coarse and ungainly plant living on river banks, native to both North America and N. Asia. B.B. 2:429.—Toward fall apt to be unsightly through the lower lvs. dying and remaining.

CC. *Plant shrubby or suffruticose.*

D. *Stems terete.*

2. **Hookeriànum**, Wight & Arn. (*H. oblongifòlium*, Hook., not Choisy. *H. triflòrum*, Blume). A suffruticose species, 2½ ft. high, thin growing: lvs. among the largest of the genus, 1–4 in. long, evergreen, ovate or oblong, sessile, dark blue-green above, pale and glaucous below, minutely pellucid punctate: corymbs several-fld., of large golden yellow fls. in profusion, 2–3 in. in diam.; sepals large, obovate; petals very large, firm, sub-rotund; stamens in 5 clusters; styles recurved, longer than the stamens: ovary broad-ovate, longitudinally furrowed.—Considered to be one of the best species because of its large fls. and hardiness. August. From the higher altitudes of the Himalayas. B.M.4949. Gn. 54, p. 490.—Easily prop. by cuttings.

3. **pátulum**, Thunb. (*H. Uràlum*, Don. *H. Nepalénse*, Hort.). An evergreen spreading under-shrub, 1½–2 ft. high, with many smooth, purplish arching branches: lvs. ovate-lanceolate, acute, without dots: fls. many, solitary or in cymes, large, 2 in. in diam., of good substance; sepals suborbicular; styles recurved: capsule ovate, more or less longitudinally furrowed. Japan, China and the Himalayas. Not very hardy, but one of the best where it succeeds. Gn. 54, p. 491. B.M. 2375, 5693. R.H. 1875:171.—Not so showy as some American species, but graceful and delicate, and one of the best for rock-gardens. Earliest to bloom.

4. **Moseriànum**, André. Gold Flower. Hybrid raised by Moser, of France, from *H. patulum* and *H. calycinum*, generally resembling the latter but lacking its coarseness, and surpassing both parents in good qualities. A glabrous subshrub 2 ft. high, erect, with the tips of the branches pendulous: lvs. similar to those of *H. calycinum*, ovate-obtuse-mucronulate, opaque, 2 in. long, dark green above, pale below: inflorescence with 1–3 fls. per stalk, which are golden yellow, 2 in. in diam., blooming for some time: calyx of foliaceous oblong sepals; corolla of broad rounded petals, their color heightened by the many tufted yellow stamens with reddish anthers: capsule top-shaped. July, Aug. R.H. 1889, p. 464. Gn. 54:1201. R.B. 16:97. G.C. III. 10:333.—Not hardy in N. England, but successful farther south. Not good individually, but good in masses, better adapted to the herbaceous border than the shrubbery. May be used as a pot-plant. Var. **tricolor**. Variegated form of white and green edged with red. Habit like *H. patulum*, but more horizontal, the lvs. smaller and narrower: fls. one-fourth the size of those of *H. Moserianum* but similar. Less hardy.

DD. *Stems angled.*

5. **calycinum**, Linn. Rose of Sharon. Aaron's Beard. A subshrub, 1 ft. or less high, with many procumbent or ascending stems occurring in thick tufts: lvs. ovate, evergreen, leathery, dark green, glaucous below, 2–4 in. long, filled with pellucid dots: fls. large, solitary, or 2–3 together, 3 in. in diameter; sepals large, obovate, spreading; stamens long and showy, in 5 clusters, with red anthers; styles shorter than the stamens, divergent: capsule ovate,4 in. long. July–Sept. B.M.146. —A rapidly spreading plant, creeping by woody rootstalks completely covering the soil. Used as a ground cover abroad. Not very hardy in New England, the annual killing-back preventing its covering wide stretches, but not destroying its bloom each year, nor its usefulness in the herbaceous border, or in the margin of a shrubbery. May be protected, and its dark, persistent foliage preserved. Thrives in sun and moderate shade. From Greece and Asia Minor. Prop. by root and ripe wood cuttings.

6. **Kalmiànum**, Linn. A shrub, 2–3 ft. high, with rather contorted stems: lvs. oblong-linear, or oblanceolate, 1–2½ in. long, bluish, more or less glaucous below, crowded: fls. small, ⅓–1 in. in diameter, in 3- several-flowered cymes; sepals foliaceous oblong; stamens distinct; styles united below to form a beak: capsule ovoid, longitudinally furrowed. G.F. 3:113. Mn. 6:141.—A rare species, confined to the rocks and sands of Niagara and the northern lakes, enduring considerable dryness. Easily adapted to the garden, succeeding in the shade. Not so showy in fl. as some other species, but good because of its bright, narrow lvs. and hardiness.

7. **lobocárpum**, Gattinger. Upright, hardy shrub, 1½ ft. high, in the South 5–7 ft.: lvs. oblong-lanceolate or linear-lanceolate, obtuse or barely acute, 1½–2 in. long: fls. profuse, small, in many-flowered naked cymes; sepals linear-lanceolate; stamens numerous; styles connivent: capsule oblong, 5-angled, furrowed. Last of August. Tenn., where it frequents marshes. G.F. 10:453. —Straggling plant of inferior quality.

BB. *Styles 3.*

C. *Fruit a berry: lvs. ovate.*

8. **Androsǽmum**, Linn. (*Androsǽmum officinàle*, All.). Sweet Amber. Common Tutsan. A dense undershrub with erect, quadrangular stems: lvs. ovate, 4 in. long, subcordate, minutely dotted, dark green, whitish below: fls. solitary or in cymes of 3–9, large, light yellow; sepals ovate; stamens in 5 clusters, longer than the corolla; ovary subglobular or oval, incompletely 3-celled; styles divergent, persistent: fr. berry-like, blackish violet, the size of a pea. June–Sept. Lives in shady, wet places, W. Europe.—Not yet proved hardy at the North. Fls. not particularly attractive, but good in fruit and foliage. All parts very aromatic.

CC. *Fr. a capsule, 1–3-celled.*

D. *Plant low, 6–15 in. high.*

9. **adpréssum**, Barton. (*H. fastigiàtum*, Ell.). Practically a herbaceous perennial, erect from a creeping or decumbent base, growing in dense masses: lvs. oblong or lanceolate, 1–2 in. long, acute, thin: cymes few–several-flowered. July, August. Moist places, Nantucket, Mass., south. B.B. 2:431. Spreads rapidly by underground stolons, suggesting occasional use as a ground cover. Not very hardy in New England.

10. **Búckleii**, M. A. Curtis. Later written Buckleyi. Dense shrub, with slender, 4-angled stems, forming neat, rounded tufts: lvs. bluish, broadly ovate oblong, ½–2½ in. long, rounded at the apex, gradually narrowed at the base, pale below, becoming scarlet in autumn: fls. solitary or in cymes of 3, 1 in. in diam.; sepals ovate; petals striated and strap-shaped; styles connate: capsule oblong-ovoid, large. June, July. Found only in the highest mountains of the Carolinas and Ga. G.F. 4:581. —Adapted to rockeries and margins of small shrubberies.

11. **élegans**, Steph. A low perennial, 1–1½ ft. high. with erect, winged stem filled with black dots: lvs. ovate-lanceolate, rather clasping, bright green: fls. racemose, 1 in. in diam., appearing in late summer and autumn; sepals ovate, much shorter than the petals, the stamens somewhat longer: capsule ovoid, with 3 apices. —A scarcely hardy plant from Siberia.

12. **Japónicum**, Thunb. Decumbent, with ovate or oval 3-nerved clasping lvs. ½ in. or less long, the stems 4-angled, 2–15 in. tall: fls. ⅓ in. across, yellow, with petals equaling the linear-lanceolate sepals and bracts; styles one-third the length of the ovary. Japan to India.—Perennial; but Hooker (Flora of India) says it is annual. Blooms in spring. Not hardy North.

DD. *Plant higher, 2–4 ft.*

E. *Leaves linear.*

13. **densiflòrum**, Pursh (*H. prolificum*, var. *densiflòrum*, A. Gray). A shrub, closely related to *H. prolificum*, but rarer: stems erect, stout, densely leafy, 4–6 ft. high: lvs. variable, broader and oblong like those of *H. prolificum*, or narrower and linear-lanceolate like those of *H. galioides*, 1–2 in. long, mucronulate: fls. ½in. in diameter, in broad, dense, many-fld. cymes; sepals narrow, not foliaceous; stamens distinct; styles connate: capsule completely 3-celled, short and slender, longitudinally furrowed. July–Sept. Pine barrens, N. J., and south. Mn. 4:97. G.F. 3:527.—R.H. 1899, p. 517, 518. Not well known, but appears to be hardy.

14. **galioides**, Lam. (*H. axillàre*, Lam., not Michx.). Practically suffruticose, but sometimes occurs as a round, compact shrub: stems erect, 3 ft. high, slender: lvs. linear, mucronulate, dark green, crowded, 1–3 in. long: fls. in dense, many-fld. cymes ¼–½ in. wide; sepals linear, foliaceous, equal, shorter than the narrow petals; stamens distinct; styles at first connate, becoming free: capsule conical, completely 3-celled, acute, longitudinally furrowed. July–Sept. Natural to low, wet grounds, Delaware to Fla., but grows freely in rich garden soil. G.F. 10:433. G.C. III. 24:301.—Seems to be perfectly hardy. Easily raised from seeds. Not well known.

15. **sphærocárpum**, Michx. Erect perennial, 1–2½ ft. high, 4-sided: lvs. linear or linear-oblong, obtuse, 1–2 in. long: cymes of many small fls. ½ in. in diameter, nearly leafless; sepals ovate, mucronate; petals 3 times longer; stamens numerous, distinct; styles united below: capsule globose, ¼ in. long. July. Frequents rocky banks of rivers, Ohio and Ky.; satisfactory in light, sandy soil.—Spreads rapidly by stoloniferous roots, covering the soil and preventing washing. Not very ornamental. Half-hardy North.

EE. *Lvs. broadly lanceolate or ovate: sepals ovate.*

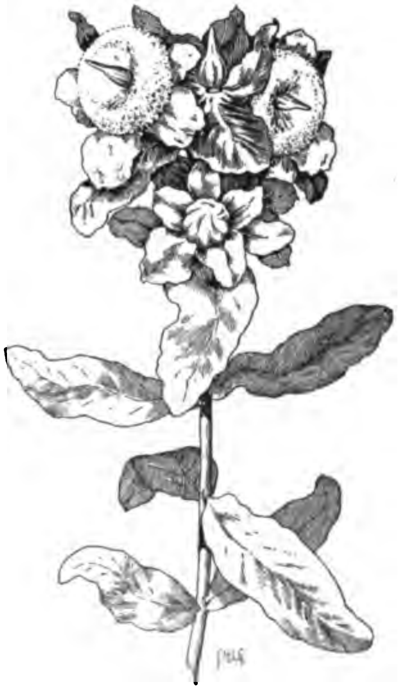
F. *Stamens and styles longer than the petals: styles divergent.*

16. **hircinum**, Linn. Glabrous subshrub of round, compact habit, 2–3 ft. high, the branches winged toward the tips: lvs. ovate-lanceolate, acute, glandular, 1–2 in. long, deep green: fls. 1½ in. wide, solitary or 3-clustered; sepals deciduous, one-third to one-fourth the length of the lance-oblong petals, which are of a deeper yellow than in the other species; stamens very long; styles spreading, longer than the stamens: capsule ovoid, pointed. July–Aug.—Species characterized by the strong, goat-like odor of the lvs. (hence the name). Of easy cultivation, but requiring a dry position and winter protection. Mediterranean region. Var. **minus**, Wats. Dwarfer, with smaller lvs. and fls.; as pretty and free-blooming as the type, and, in the rock-garden, preferable.

17. **elàtum**, Dryand. Strong, tufted undershrub, recalling *H. Androsæmum*, 3–4 ft. high, not quite hardy, sometimes credited to the United States, but really from the Canaries: lvs. oval, 1½–3 in. long, dark green, whitish below, acute: fls. numerous, 1 in. in diameter, in 3–7-flowered cymes; sepals ovate-oblong; stamens distinct; styles prolonged, distinct: capsule oblong, small. July.

18. **floribúndum**, Dryand. A subshrub, with round, glabrous stems: lvs. lanceolate-elliptic, light green, without dots, numerous, 1–1½ in. long: fls. in few- to many-flowered panicles, 1½–2 in. in diameter, with dilated peduncles: sepals somewhat acute; stamens numerous, shorter than the petals, petals and stamens persistent; ovary oval; styles long, divergent, with capitate stigmas.—From the Canary and Madeira Islands. Not hardy North, but in cultivation in S. California. Grows very rapidly to the height of about 12 ft. Generally prop. from seeds, which are produced freely.

19. **multiflòrum**, Hort., not HBK. A supposed hybrid between *H. Androsæmum* and *H. elatum*, assuming an intermediate form, but more closely resembling *H. elatum*. It also resembles *H. hircinum*, but is more shrubby and taller. Lvs. ovate-oblong, acute, somewhat clasping, 1–2 in. long: fls. in profusion, several in a cyme, 1 in. wide, lasting two weeks; sepals small, ovate reflexed; styles spreading: capsule oblong. July.—Not very hardy.



1118. Hypericum aureum (× ½).

FF. *Stamens and styles shorter than the petals: styles connivent.*

20. **aùreum**, Bartram. Fig. 1118. Showy shrub 3 ft. high, more woody than most species, of stiff, dense habit, top often globular like a miniature tree, the branches 2-edged, with thin, exfoliating red bark: lvs.

oblong, mucronate, bluish, pale below, leathery: fls. solitary in the native state, in cymes of several in cultivation, 1½–2 in. in diam., bright yellow, heightened by the golden filaments at the center; bracts leaf-like, lasting two weeks; sepals leaf-like, ovate, shorter than the thick, broad petals, which persist until withered; stamens distinct, very numerous; styles connate: capsule ovate acuminate, red. July–Aug. Affects rocky situations when wild, generally shady, where moisture is longest retained, from Ga. and Tenn., but perfectly hardy in Mass. G.F. 2:185.—Prop. by seeds and cuttings, young plants from seed blooming the second year.

21. **nudiflòrum**, Michx. (*H. cistifòlium*, Coulter, not Lam.). Showy subshrub, 1–2 ft. high, with quadrangular winged branches: lvs. ovate-lanceolate or oblong, subacuminate or obtuse, 2–3 in. long, thin, veiny, pale above and below, with minute reddish dots: cymes leafless, loosely flowered, of many small fls; sepals linear to oblong; styles united: capsule ovate-conical, ¼ in. long. N. C. and S.—Ornamental and of easy cultivation.

22. **prolificum**, Linn. (*H. foliòsum*, Jacq. *Myriándra prolífica*, Spach). A stout, dense shrub, 3 ft. high, with terete branches and exfoliating light brown bark, the twigs 2-angled: lvs. oblong or oblanceolate obtuse, 1–3 in. long, glossy, dark green, pellucid, punctate: fls. in profusion, 1½ in. wide, in several- to many-flowered cymes; sepals lance-ovate; stamens numerous, distinct; styles united at the base: capsules large, oblong, ½ in. long. July–Sept. Found in sandy or rocky soil, New Jersey to Iowa and Georgia; one of the most commonly cultivated. G.F. 3:526—A strong, hardy shrub. Grows rapidly in ordinary garden soil, flowering regularly and profusely. Varies greatly in size.

BBB. *Styles united throughout.*

23. **Chinénse**, Linn. (*H. monógynum*, Willd. *H. salicifòlium*, Sieb. & Zucc.). Shrubby, half evergreen: lvs. narrow, elliptic and obtuse, 1–2 in. long: fls. large, yellow, with long stamens resembling "fine golden wire." Mar.–Sept. Orient. G.C. III. 1:705.—Said to be known only as a garden plant. Tender. Grown under glass in parts of the Old World.

AA. *Flowers pink.*

24. **Virgínicum**, Linn. (*Elodèa campanulàta*, Pursh. *Elodèa Virgínica*, Nutt.). MARSH ST.-JOHN'S-WORT. Smooth perennial, 1–1½ ft. high, nearly simple: lvs. numerous, oblong or oval, cordate, clasping, rounded, 1–2½ in. long: fls. ½ in. in diam., pink- or flesh-colored, in small, close cymes; sepals equal; petals oblong; stamens at least 9 in 3 sets; styles distinct: capsule oblong. July, Aug. In swamps, Labrador to Louisiana. B.B. 2:436.—Useful plant for an artificial bog, and thrives well also in any fine, loamy soil in the shade or sun.

H. Ægýpticum, Linn. Dwarf shrub, with very small yellow lvs. and minute, solitary fls. in profusion. Not hardy. Mediterranean region. G.C. II. 14:503.—*H. Baleàricum*, Linn. Curious evergreen species, with small oblong lvs. ½ in. long, warty beneath and on the twigs: fls. few, large, solitary. Not very hardy. Mediterranean region.—*H. Còris*, Linn. Procumbent shrub, with linear lvs. in whorls, flowering May–Sept. Not hardy. Central and S. Europe.—*H. dolabrifórme*, Vent. Procumbent perennial, with ascending stems 6–20 in. high, with small narrow lvs. and fls. 1 in. wide. Not very hardy. Ky. and S.—*H. Elòdes*, Huds. Procumbent perennial, with round-ovate, tomentose lvs. and few-flowered, pale yellow panicles. Suitable to boggy places. Europe.—*H. empetrifòlium*, Willd. Neat, evergreen subshrub in patches, 6–12 in. high, with fine lvs. and fls. Not hardy.—*H. fasciculàtum*, Lam. Tall shrub, 3–6 ft., erect, with numerous small linear lvs. and small fls., and frequenting marshy places South. Not tested North.—*H. inodòrum*, Mill. Dense arching or pendulous shrub, 1½ ft. high, with oblong lvs. and few fls.—*H. nummulàrium*, Linn. Perennial, from the Pyrenees, with ascending stem and orbicular lvs.—*H. Olýmpicum*, Linn. Evergreen shrub, with lanceolate lvs. and fls. 1–2 in. wide, with narrow petals. Gn. 30:590.—*H. opàcum*, Torr. & Gray. Southern shrub, 1–4 ft. high: lvs. small, pointed, numerous: fls. small, in many-flowered cymes: stems erect, slender Half hardy North. G.F. 5:305.—*H. orientàle*, Linn. Half-hardy, erect perennial, 6–12 in. high, with linear lvs. Asia.—*H. perforàtum*, Linn. The common perennial species of the fields naturalized from Europe, with elliptical oblong or linear-oblong lvs. and numerous fls. in leafy, open cymes.—*H. púlchrum*, Linn. Central European species, with cordate connate lvs. Not hardy.—*H. ramosissimum*, Hort. Dense, upright and slightly pendulous shrub, 1½–2 ft. high, with large elliptical lvs. and fls. in clusters. Hardy.

A. PHELPS WYMAN.

HYPHÆ̀NE (Greek, *to entwine;* referring to the fibers of the fruit). *Palmàceæ.* About 11 species of fan-leaved palms from tropical Africa and Madagascar. The Borassus tribe of palms consists of Borassus, Lodoicea, Latania and Hyphæna. In the first two the staminate fls. in the pits of the spadix are numerous; in the last two they are solitary. In the first and fourth there are few stamens; in the second and third the stamens are numerous. Hyphæne consists of unarmed palms of moderate or tall stature: caudex robust, cylindrical, ventricose or pear-shaped, simple or forkingly branched: lvs. terminal, orbicular, palmate-flabelliform, plicate-multifid; segments ensiform, acute or 2-fid, margins induplicate with fibers interposed: rachis short: petiole strongly biconvex or a trifle flatter above, margins minutely spiny: ligule short, rotund; sheath short, open.

Hyphæne crinita does not look at all like Latania. It has long, thick seed-leaves, and has withstood the cold at Oviedo, Fla., better than any other palm. It is extremely slow of growth, and cannot be desirable as a house plant. It is probably cult. more in northern conservatories than in the South.

crinita, Gærtn. (*H. Natalénsis*, Kunze). Young fronds 1 to 1½ ft. long, lanceolate, bi- or trifid at the apex, bright green, clothed on both sides with a white

1119. Star-grass, Hypoxis erecta (× ⅓).

bloom which soon vanishes, plicate, scabrous on the margins and nerves above; petiole sheathed for 1 or 2 in., deeply channeled above, rough on the margins: fruits obovate, 2½ in. long, smooth. S. Africa. Cult. outdoors in S. Fla.

Jared G. Smith and E. N. Reasoner.

HYPOCRITE PLANT. *Euphorbia heterophylla.*

HYPÓLEPIS (Greek, *a scale underneath*). *Polypodiàceæ.* A genus of ferns with marginal sori, placed in the sinuses of the leaf, covered with the membranous leaf margin. Tropical ferns of both hemispheres rarely cultivated. Ten or more species are known.

rèpens, Presl. Stalks straw-colored, more or less prickly: lvs. 3–4 ft. long, quadripinnatifid; lower pinnæ 1–2 ft. long, 6–12 in. wide, ovate acuminate: sori 2–6 to a segment. West Indies to Brazil.

Hypolepis repens is a rather coarse fern, of easy culture, with the general appearance of a Cyathea. Like all strong-growing ferns, it requires a large percentage of loam. It likes shade and moisture at all times, and is readily propagated by spores, which it produces in great quantity. It often sows itself, and requires a stove or intermediate temperature.

H. Californica. See *Cheilanthes Californica.*

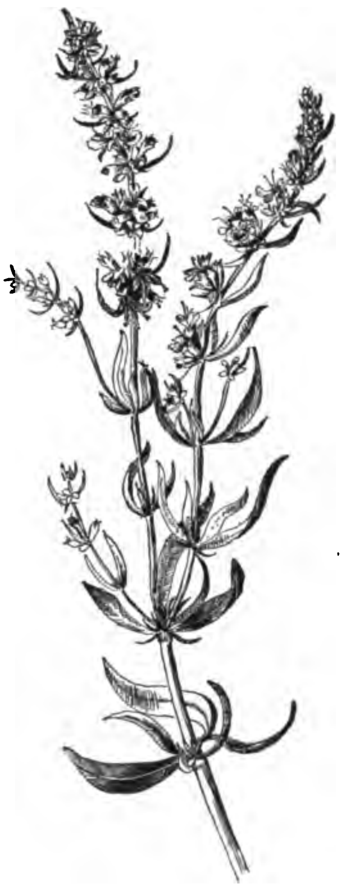
L. M. Underwood.

HYPÓXIS (old Greek name, of no application to these plants). *Amaryllidàceæ.* Star-Grass. About 50 species of little herbs of temperate and tropical regions, with linear leaves, hard rootstalks or corms, perianth adnate to the ovary, and anthers not versatile. They are scarcely known in cultivation, although the common species of the northern states, **H. erécta**, Linn. (*H. hirsùta*, Coville), Fig. 1119, is offered by dealers in native plants. The lvs. are radical, hairy, grass-like: fls. 1–6, small, star-like, bright yellow, on scapes 4–10 in. tall. Give a half-shady place in the rockery or border. Prop. by division. Blooms in spring. Not showy, but interesting. D. 143. G.W.F. 39. **H. stellàta**, Linn. f., from S. Africa, is a pretty greenhouse bulb, blooming in Dec.: lvs. 4–12, glabrous, a foot or less long: peduncles sometimes forked, 1–4, bearing fls. white inside, and the outer segments green-striped on the back.

J. B. Keller and L. H. B.

HÝSSOPUS (ancient name; but precisely what plant was the sacred Hyssop of the Jews is uncertain). *Labiàtæ.* Hyssop. Hyssop is a familiar plant, cultivated for medicine and also for ornament in hardy borders. It is considered a genus of only one species, the numerous synonyms being referred mostly to *H. officinalis* or to the genus Lophanthus, 2 species of which are cult. Hyssopus has entire lvs.: Lophanthus has serrate lvs. Important generic characters of Hyssopus are the 15-nerved calyx and divergent stamens: upper lip of corolla 2-lobed; lower 3-lobed: stamens 4, didynamous, 2 of which are exserted.

officinàlis, Linn. Fig. 1120. Stems herbaceous from a woody base, slender, branched or not: lvs. linear to oblong, sessile or nearly so, acute at both ends or the lower ones obtuse at the apex, 1½–2 in. long. B.M. 2299. B.B. 3:110. Var. **álba**, with white fls., is cult.



1120. Hyssop—Hyssopus officinalis (× ½).

Hyssop is a hardy perennial shrub, growing 18 in. tall, which has been naturalized in the United States from southern Europe or Siberia. Lvs. narrow and entire: fls., which appear from June to September, blue, sometimes white or pink, borne in whorled spikes, which are more or less interrupted. The whole plant has a strong odor and pungent, bitter taste. The green parts are used in connection with wormwood and other plants in the manufacture of absinthe, occasionally as a pot herb, and as a flavoring for cold salad plants. The powdered, dried flowers are similarly employed in soups. The flower spikes are cut just as the blossoms begin to open, and are dried for use in domestic medicine as a stimulant and expectorant in the treatment of asthma, coughs and other pulmonary troubles. Hyssop is not now so highly esteemed as formerly by the medical profession.

This plant is readily propagated by seed, cuttings and plant division. The seed, generally employed in cold climates, is sown in early spring, either in drills 15 to 18 inches apart where the plants are to remain, or broadcast in nursery beds for transplanting, 12 inches asunder in June or July. Propagation by cuttings and by division may be done in the autumn, but better in the spring, when the plants first start to grow. Greenwood cuttings may be started in the shade in the early summer. They need to be well watered. The soil should be a light, mellow, calcareous or sandy loam, with a warm aspect. Culture and harvesting are the same as for sage, mint and other herbs. The beds should be renewed every three or four years.

M. G. Kains.

I

IANKÆA. A misprint for Jancæa. See *Ramondia.*

IBÈRIS (from *Iberia*, the ancient name of Spain, where the genus is abundant). *Cruciferæ.* A genus of about 30 species, native to southern Europe, western Asia and northern Africa, all low-growing annuals, biennials and subshrubs. Comparatively few species are cult. The annuals are the common Candytuft of gardens. The biennials are not cultivated. The subshrubs are flat, dwarf, compact, commonly evergreen plants, with dark green lvs., completely covered with broad, flat or elongated clusters of irregular cruciferous fls. in spring.

The annuals are showy branching plants, 6–18 in. high, much grown in masses in beds or for edging. Florists grow them also, especially the white varieties, for cut-flowers. They are of easy cultivation, and succeed in any rich garden soil, in a place exposed to light and air. They are propagated by seeds, which may be sown at any season, in the house or open ground, but particularly in the fall when the climate permits, or as early as possible in spring, in rows 6–8 in. apart where the plants are to grow, the plants being thinned later to 4 in. apart in the row. The finest display is attained from autumn-sown plants, which flower from May to July. If seed is sown in autumn, the plants should be slightly protected from the sun during winter. Seeds sown early in the spring bloom from July to September. Continuous bloom may be obtained by sowing every two weeks. Good results are attained by sowing under glass and transplanting into open ground when the soil is warm. The name Candytuft was given because the fls. appear in tufts and because the first introduced species, *I. umbellata*, was brought from Candia.

The subshrubby species are adapted to the front of shrubberies, where they connect taller plants with the surrounding lawn. They may appear in separate clumps, in broad masses, or may mingle with other genera in the herbaceous border. They are suited to rockeries, and hang well over walls and ledges. They are to be treated much like herbaceous perennials. They are plants of refinement, and are pleasing when close to the observer. They are useful and popular for cut-flowers, are easily forced into bloom in winter, and are adapted to pot and pan culture. They are easily propagated. The perennial Iberis succeed best when let alone. Once planted and not disturbed, they soon form a dense foliage. They are the best spreading, dwarf plants with white flowers.

Iberis is a genus of glabrous or minutely downy plants, with terete stems and pungent, watery juice: lvs. alternate, without stipules, linear or obovate, entire or pinnatifid, often fleshy: fls. perfect, in terminal corymbs or racemes; sepals 4, inferior, deciduous; petals 4, hypogynous, white or purple, obovate, with short claws, very unequal, opposite each other in pairs, their spreading limbs forming an irregular cross, the two outer petals much larger and about equal in size: pods or silicles roundish or ovate at the base, flattened at right angles to the narrow partition, notched at the top, in which stands the permanent style, the 2 valves boat-shaped, the keel or midrib expanding into a wing, the cells 1-seeded. The characters of Iberis as distinguished from other Cruciferæ are taken almost wholly from the pods and seeds, the fls. being similar to most cruciferæ except that they are irregular.

A. Phelps Wyman.

The common white-fld. annual Candytuft is *I. amara.* The common annual kinds with colored fls. are *I. umbellata.* The common perennial kind is *I. sempervirens.* The clusters of some kinds remain rather flat-topped when they run to seed, while the clusters of other kinds lengthen after flowering. This is expressed in technical language under A and AA in the key which follows:

A. *Inflorescence racemose in fruit.*
  B. *Annuals: stems not woody at the base.*
    C. *Lobes of the pod erect.*
      D. *Lvs. toothed* .... 1. **amara**
      DD. *Lvs. pectinate* (*i.e., divisions deeper, narrower, and farther apart*) ... 2. **pectinata**
    CC. *Lobes of the pod spreading.*
      D. *Lvs. merely toothed* 3. **odorata**
      DD. *Lvs. deeply cut* (*pinnatifid*) ..... 4. **pinnata**
  BB. *Perennials: stems woody at the base.*
    C. *While in flower racemose* .... 5. **sempervirens**
    CC. *While in flower corymbose.*
      D. *Margin of lvs. entire.*
        E. *Form of lvs. linear.*
          F. *Apex of lvs. subacute*.... 6. **saxatilis**
          FF. *Apex of lvs. obtuse* ...... 6. **saxatilis, var. corifolia**
        EE. *Form of lvs. oblong, narrow at base*........... 7. **Garrexiana**
      DD. *Margin of lvs. toothed toward apex* .... 8. **Gibraltarica**
AA. *Inflorescence corymbose in fruit.*
  B. *Annuals: stems not woody at the base*..... 9. **umbellata**
  BB. *Perennials: stems woody at the base.*
    C. *Lvs. crenate*.........10. **Tenoreana**
    CC. *Lvs. entire or subdentate.*
      D. *Radicle descending: seed not margined: septum simple*......11. **Pruiti**
      DD. *Radicle horizontal: seed somewhat margined: septum nearly double* ....12. **semperflorens**

INDEX.

affinis, 2.
amara, 1.
corifolia, 6.
coronaria, 1.
Dunnetti, 9.
Garrexiana, 7.
Gibraltarica, 8.
odorata, 3.
pectinata, 2.
pinnata, 4.
Pruiti, 11
saxatilis, 6, 7.
semperflorens, 12.
sempervirens, 1, 5.
Tenoreana, 10.
umbellata, 9.

1. **amàra**, Linn. Common Annual C. Bitter C. Clown's Mustard. Lvs. lanceolate, toothed toward apex: fls. white. Common in Eu. S.B.F.G. II. 359. The best form is var. **coronària**, Voss (*I. coronària*, Hort., not D. Don). Rocket C. This has larger and fuller clusters and larger fls. The taller varieties, Empress, Spiral White and Giant Snowflake, grow 18 in. high, with solid pyramidal trusses 5–8 in. long. Dwarf forms are Tom Thumb and Little Prince. All are good bedders, and Empress is fine for cutting. Seed may be sown at any time, but the best results with Empress are secured by sowing under glass and transplanting to the open, where plants will bloom in May and June.

2. **pectinàta**, Boiss. (*I. affinis*, Hort., not Jord.). Fls. white. Spain. Advertised only as *A. affinis.*

Likely to be confused with *I. odorata*, but the petals are 4 times as long as the calyx and the pods have short hairs, while in *I. odorata* the petals are 1½ times as long as the calyx and the pods glabrous.

3. **odoràta**, Linn. Sweet-scented or Fragrant Candytuft. Lvs. linear: fls. white. Crete. S.B.F.G. 50. Frequently confused with *I. pinnata*. Better and more fragrant in poor soil.

1121. Iberis Gibraltarica (× ½).

4. **pinnàta**, Linn. Not advertised in America, but often sold as *I. odorata*. Fls. white: inflorescence only slightly elongated in fruit. Spain, S. France, Italy.

5. **sempérvirens**, Linn. Evergreen C. Lvs. oblong, obtuse, narrowed at base, glabrous: fls. white. Crete. Gng. 2:145 (fine habit sketch). F.R. 1:75 (poor). Var. **plèno**, a double form, is cult., but is less desirable. Var. **ròsea** and var. **fòliis variegàtis** are sold abroad. Var. **supérba** or Perfection is said to be one of the best forms.—This is the commonest, hardiest and most permanent of the perennial kinds. When the rarer and tenderer kinds are winter-killed *I. sempervirens* is likely to spread out and surround the labels of other kinds. This probably explains why some of the most reliable dealers have sold this plant under other names, particularly *I. Gibraltarica*.

6. **saxátilis**, Linn. Lvs. glabrous or ciliate: fls. white. S. Eu.

Var. **corifòlia**, Sims (*I. corifòlia*, Sweet). Lvs. glabrous: fls. white. B. M. 1642, though this picture was doubtfully referred by Baker to *I. Garrexiana*.

7. **Garrexiàna**, All., not Scop. Lvs. glabrous: fls. white. Piedmont, Pyrenees. Referred by Index Kewensis to *I. sempervirens*. Intermediate between *I. sempervirens* and *I. saxatilis*, having the habit of the latter.

8. **Gibraltárica**, Linn. Fig. 1121. Lvs. wedge-shaped, obtuse, subciliate: outer fls. pink, inner ones white. Gibraltar. B.M. 124. Gn. 10:308. R.H. 1870:330. Gn. 24, p. 549, same as R.H. 1885, p. 446.—This is considered by some as the most striking and showy of the perennial kinds. It grows higher and more erect, with larger clusters and larger fls., but is less hardy than the others. This is much sought after, and the stock in the nurseries is often not true to name. Var. **hýbrida** is advertised.

9. **umbellàta**, Linn. Lvs. lanceolate, acuminate, lower ones serrate, upper ones entire: fls. in the wild typically purplish, rarely white: pods acutely 2-lobed. Italy, Crete, Spain. B.M. 106.—This is the common annual Candytuft with colored fls., the colors being more numerous and better fixed than in any other species. American trade names are vars. **carmínea**, **cárnea**, **lilacina** and **Dúnnetti** (*I. Dúnnetti*, Hort.), the last being dark purple. Vars. **ròsea**, **purpùrea** and **álba** are advertised abroad, also vars. **nàna**, **pùmila** and **hýbrida**. Tall and dwarf forms of all the colors are procurable.

10. **Tenoreàna**, DC. Lower lvs. obovate, narrowed at base: upper lvs. oblong-linear: fls. purplish or whitish: pods notched at apex. Naples. B.M. 2783. L.B.C. 18:1721. According to Baker (G.C. 1868:711), this is the only perennial kind that is decidedly hairy. DeCandolle says the lvs. are puberulous.

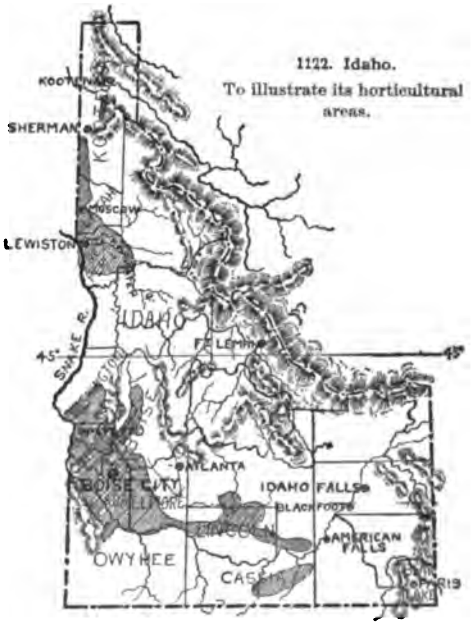
11. **Prùiti**, Tineo. Lvs. glabrous, obovate-spatulate, entire or subdentate: fls. white: pods merely notched at apex. Sicily. Not advertised here, but cult. abroad.

12. **sempérflorens**, Linn. Lvs. wedge-shaped or spatulate, obtuse, entire, glabrous: pods scarcely notched at apex. Sicily and perhaps Persia. The characters in the key under D and DD distinguish this from all the other species of Iberis. Once advertised by Pitcher & Manda, together with var. **pleno**, a double variety. Var. **foliis variegàtis** said to be cult. abroad.

I. caridcea, once advertised by Saul, is presumably a typographical error.—*I. cordifòlia* is a frequent error for I. corifolia.—*I. correæfòlia*, Hort., is a common trade name abroad, which is usually spelled I. corræfolia in American catalogues. There is no genus Corra, and Correa is an Australian plant of the Rutaceæ. Specimens should therefore be compared with I. saxatilis, var. corifolia. Mottet's description, however, would place this plant directly after Garrexiana in the key, being distinguished from Garrexiana by the flowers becoming purplish instead of always remaining white. Mottet says that I. correæfolia, Hort., is a hybrid, with spatulate, entire, obtuse lvs. This question could be quickly settled if seedsmen would keep dried specimens of their plants.—*I. Ibèrica*, of John Saul's catalogue, 1893, is not in Index Kewensis.—*I. lilacina* of careless trade catalogues is presumably a lilac-fld. variety of I. umbellata.—*I. nàna hýbrida*, Hort., is not I. nana, All., a distinct botanical species, but a trade name of mixed dwarf varieties of some common annual kind, presumably I. umbellata. W. M.

ICE PLANT is *Mesembryanthemum crystallinum*.

IDAHO, HORTICULTURE IN. Fig. 1122. The state of Idaho lies entirely west of the Rocky Mountain range, whose summit line forms the northeastern boundary. All drainage and waterways of the state finally reach the Columbia river by many directions and extensions of numerous rivers and creeks, excepting for a small area in the extreme southeastern portion of the state, which drains to the Great Salt Lake, in Utah. Generally the state is very mountainous, but a considerable area of the southern portion constitutes the high table-lands lying on both sides of the Snake river. Most of the state lies above an altitude of 2,000 feet. At and near Lewiston, in the valleys of the Snake and Clearwater rivers, the altitude drops suddenly to 647 feet and upwards. The numerous mountain chains and peaks which cover this vast Rocky Mountain slope, direct the streams in endless ways to their outlets into the large rivers. Thus it can be understood that climatic influences are extremely variable. Altitude does not altogether determine the character of the climate in the valleys. The prevailing currents of air in a given locality are often influenced and directed by the direction of the mountain ranges and the proximity of snow-clad peaks. Greater



1122. Idaho. To illustrate its horticultural areas.

extremes of temperature prevail in the southern portion of the state than in the northern. The summers are hotter in the south than in the north, and the rigors of winter are more severely experienced.

Irrigation for the successful cultivation of crops is necessary over most of the southern portion of the state, below the 45th parallel of latitude. North of this there is generally an abundance of rainfall, the atmosphere is humid, and the soil is retentive of moisture. The native soils of Idaho are mostly of volcanic origin, interspersed with clay and sandy loam, and altogether quite fertile. Excepting in the narrow mountain valleys, and in the deep canyons of the Snake river, altitude largely determines the character of horticultural pursuits. According to the United States Weather Bureau records, some of the altitudes are these: Lewiston, 647 feet; Kootenai, 1,750; Payette, 2,150; Fort Sherman, 2,196; Moscow, 2,571; Boise, 2,880; American Falls, 4,341; Blackfoot, 4,503; Fort Lemhi, 4,700; Idaho Falls, 4,732; Paris, 5,946; Atlanta, 7,000. The known altitudes are named at points which are considered most advantageous for estimating variations for the whole state. Much of the south-central portion of Idaho contains vast lava beds, and hundreds of square miles are thus occupied. Among them, however, lie fertile irrigated areas. The wild sage brush covering these extensive tablelands grows most luxuriantly, often attaining to a height of six feet and over. Along the streams and bottomlands of southern Idaho are growths of willows and poplars, and in the mountain gulches a black haw and dwarf maple skirt the water courses. Very little shrubbery grows in the mountains. In the mountain regions above an elevation of 4,500 feet, pine, spruce and fir abound. That portion of the state north of the 45th parallel contains fine forests of pine, fir, tamarack and cedar. The mountains, hills and valleys are also well covered with small deciduous trees and shrubbery, which for ages have contributed towards the establishment of a soil rich in organic matter. The list of species of deciduous plants found native in this part of the state is so extensive that it would seem out of place to name them in this article. There are no wild fruits of economic importance growing in the state.

Horticultural operations are conducted within narrow limits above an altitude of 4,500 feet. Up to 3,500 feet elevation, fruit-raising has shown great promise. The best adapted sections for raising apples lie within the counties of Latah, Nez Perce, Washington, Canyon, Ada, and more limited in portions of Elmore, Boise, Cassia, Owyhee, Lincoln and Kootenai. Apples can also be produced in other counties to a very limited extent. Even in Bear Lake county, at an elevation of 6,000 feet, some varieties are being raised successfully.

The horticultural inspectors of the various horticultural districts last year made a careful computation of the fruit acreage in their respective territories, and reported as follows: Ada county, 5,581 acres; Bannock, 100; Bear Lake, 100; Bingham, 1,100; Blaine, 350; Boise, 141; Canyon, 5,360; Cassia, 507; Custer, 185; Elmore, 875; Fremont, 1,000; Idaho, 200; Kootenai, 1,500; Latah, 5,900; Lemhi, 200; Lincoln, 840; Nez Perce, 2,000; Oneida, 1,000; Owyhee, 216; Shoshone, 1,200; Washington, 2,450. These figures show for the whole state a total of 30,805 acres planted to fruit. The figures include orchards, vineyards, and small fruit plantings, and are considered very reliable. Considerably the largest acreage is apples; then follow prunes, peaches, pears, cherries, nectarines and quinces in the order named. Small-fruit growing covers an important portion of the acreage given.

All kinds of forest trees suitable to northern climatic conditions can be grown with excellent success within the state.

F. A. HUNTLEY.

IDÈSIA (Yobrants Ides, Dutch traveler in China). *Bixàceæ.* A genus whose only species is a Japanese tree, hardy as far north as Philadelphia. It is a large, rapid-growing, deciduous tree, with large lvs. borne on reddish stalks and loose clusters of fragrant, greenish yellow fls. which are inconspicuous except for their prominent anthers, and numerous orange-colored berries about the size of a small cherry. Fls. diœcious, the parts in 5's (or 3–6); sepals tomentose, imbricated, deciduous; petals 0; stamens indefinite, inserted on a small disk with villous filaments: ovary of pistillate fls. globose: berries with an indefinite number of seeds. Prop. by green wood and root cuttings.

polycárpa, Maxim. Height 40 to 50 ft.: lvs. drooping, 5–10 in. long, sometimes 8 in. broad, usually cordate-acuminate, sometimes oblong or orbicular, deep green, margin distantly serrate, glaucous beneath, petiole 4–6 in. long: panicles shorter than the lvs., pendulous: staminate fls. ⅓ in. across. Var. **crispa** has curled foliage. B.M. 6794. R.H. 1872, pp. 174, 175; 1878, p. 254; 1888, pp. 463–465. F. 1874, pp. 64, 65.

JOSEPH MEEHAN and W. M.

ILEX (the ancient Latin name of *Quercus Ilex*). Including Prinos and Othera. *Ilicineæ* (or *Aquifoliàceæ*). HOLLY. Ornamental evergreen or deciduous shrubs, with alternate, simple, sometimes spiny lvs., small, inconspicuous, whitish fls. in axillary clusters or solitary, and black, red or sometimes yellow berries, remaining on the branches often until the following spring. Of the evergreen species, only *I. glabra* and *I. rugosa* are quite hardy North, and also *I. opaca* and *I. crenata* in somewhat sheltered positions. *I. Aquifolium* and *I. cornuta* are more tender but stand many degrees of frost if sheltered, while most of the others can only be grown South. Of the deciduous species, *I. decidua*, *I. monticola*, *I. lævigata* and *verticillata* are hardy North; also *I. Sieboldi* and some other Japanese species are hardy or nearly so. The Hollies, especially those with scarlet or red berries, are highly ornamental, and the berried branches of *I. opaca* and *I. Aquifolium* are in great demand for Christmas decoration. Also *I. lævigata* and *verticillata*, the prettiest in fruit of the deciduous kinds, are sometimes sold for this purpose. The deciduous species are mostly shrubs, while many of the evergreen species grow into small or medium-sized trees, and *I. opaca* is the tallest of the broad-leaved evergreens which are hardy North; the evergreens *I. crenata*, *glabra*, *rugosa*, always remain shrubby. *Ilex opaca* fills the old, deserted and very dry and sunny, barren fields of the South, and thrives on extremely poor soil, and has good color, too. This trait is worth noting. *I. Aquifolium* is a favorite evergreen in English gardens, and numerous varieties are there in cultivation; it stands severe pruning well, and can be clipped and trained into almost every shape; it also makes fine hedges, but its slow growth is a disadvantage. As the chief value of the deciduous species is in the ornamental fruits and the Hollies are diœcious, care should be taken to select in planting a few staminate ones, but mostly pistillate plants, and to give the latter the most prominent place. The light, close-grained and tough wood of some of the arborescent species is much valued for turnery-work, engraving and cabinet-making. The lvs. of some tropical species, as *I. Paraguariensis* and *I. conocarpa*, yield a kind of tea known as Yerba de Maté, or Paraguay Tea, which is much used in S. America. The Hollies grow best in rich, well-drained soil, and the evergreen ones in partly shaded situations, but *I. lævigata*, *verticillata* and also *Sieboldi* prefer moist places, and grow even in swamps. Most of the species grow slowly, and are not easily transplanted when older. The best time for moving the evergreen species is the early fall, when the young wood has almost ripened, or in the spring just before the plants start into new growth. The leaves should be stripped on *I. opaca* and *I. Aquifolium*, when transplanted, particularly if at all exposed—or at least nearly all. This is absolutely necessary to insure success. Wild Hollies may be handled this way with success, particularly if cut back as well. Prop. by seeds, which do not germinate until the second year, and are therefore stratified and treated like those of the slow-growing hawthorns. The young seedlings should be transplanted after the second year. The evergreen species may be increased by cuttings of ripened wood under glass, especially the shrubby ones; they are also sometimes grafted or budded on seedlings of *I. Aquifolium* or *opaca*. About 175 species in N. and S. America, tropical and temperate Asia and few in Africa, Australia and Europe. Lvs. petioled, with small, caducous stipules: fls. diœcious, usually in rather few-fld. axillary cymes; calyx lobes, petals and stamens usually 4, sometimes more; style very short: fr. a berry-like drupe, with usually 4 bony 1-seeded stones.

Index of names accounted for below, besides those in the supplementary list:

INDEX.

albo-marginata, 17.
albo-picta, 18.
angustifolia, 34.
Alteclarensis, 2.
Aquifolium, 1.
argenteo-marginata, 17.
argenteo-medio-picta, 18.
argutidens, 46.
aureo-marginata, 20.
aureo-regina, 20.
aureo-maculata, 19.
aureo-picta latifolia, 21.
Cassine, 33 and 37.
cornuta, 31.
crenata, 38.
crispa, 16.
Dahoon, 33.
decidua, 40.
dubius, 41.
echinata, 3.
ferox, 3.
ferox argentea, 22.
ferox aurea, 23.
Fortunei, 38.
fructu aurantiaco, 28.
fructu luteo, 27.
glabra, 39.
Handsworthensis, 7.
hastata, 8.
heterophylla, 12.
heterophylla aureo-picta, 24.
lævigata, 43.
latifolia, 4 and 36.
latifolia marginata, 20.
laurifolia, 13.
marginata, 14.
microphylla, 9.
mollis, 42.
monticola, 41.
myrtifolia, 10 and 35.
opaca, 32.
pendula, 29.
platyphyllos, 5.
princeps, 6.
pyramidalis, 30.
quercifolia, 32.
Scotica, 15.
Scotica aurea, 25.
serrata, 45.
serratifolia, 11.
Sieboldii, 47.
tortuosa, 16.
verticillata, 44.
vomitoria 37.
Wateriana, 26.

A. *Foliage evergreen.*

B. *Lvs. with coarse, spiny teeth, rarely mostly entire.*

C. *Fls. in axillary clusters on branches of previous year.*

1. **Aquifòlium**, Linn. EUROPEAN HOLLY. Fig. 1123. Tree, to 40 ft., with short, spreading branches, forming an oblong or pyramidal head, in cultivation often shrubby, glabrous: lvs. short-petioled, usually ovate or oblong-ovate, waved and with strong, spiny teeth, shining, 1½-3 in. long: fr. scarlet, globular, shining. May, June. Southern and middle Eu., western Asia, China. Gng. 4:83.—A very variable species. A full account of the numerous varieties cult. in England is given by T. Moore in G.C. II. 2, p. 433, 519, 687, 751, 812; 4, p. 687, 741; 5, p. 43, 365, 437, 624; 6, p. 232, 389, 616, where 153 varieties are described and many of them figured. Some of the most important and most distinct are described below. *Osmanthus Aquifolium*, Sieb. & Zucc., an oleaceous shrub, which may readily be known by its opposite leaves, is occasionally supplied by dealers as a variety of *Ilex Aquifolium*.

(a.) *Foliage green.*

(b.) *Lvs. spiny-toothed.*

(c.) *Size of lvs. large, about 2-4 in. long.*

2. Var. **Altaclarénsis**, Hort. Lvs. oval, large, thin and rather plain, with numerous teeth. 3. Var. **fèrox**, Loud. (*I. echinàta*, Mill.). Lvs. of medium size, with strong teeth and numerous small spines on the upper convex surface. A very distinct variety, known as Hedgehog Holly. N. 2:175. 4. Var. **latifòlia**, Loud. Lvs. oval to 3½ in. long, with rather few, divaricate teeth. G.C. II. 2:433. 5. Var. **platyphýllos**, Hort. Lvs. broadly ovate, to 3½ in. long, with divaricate spines, thick, deep green. 6. Var. **princeps**, Moore. Lvs. broadly ovate, to 4½ in. long, with strong, regular spines, dark green, with prominent veins below. G.C. II. 13:45.

(cc.) *Size of lvs. small, 1-2 in. long.*

7. Var. **Handsworthénsis**, Hort. Lvs. ovate-lanceolate, with numerous, moderately divaricate spines, projected toward the apex, glossy green. G. C. II. 2:519. 8. Var. **hastàta**, Hort. Lvs. ovate-lanceolate, halbert-shaped: spines large, usually only 2-4 on each side at the base, the upper half usually entire. G. C. II. 2:687. 9. Var. **microphýlla**, Hort. Lvs. ovate-lanceolate, about 1 in. long, shining green, with small, equal plane spines. G.C. II. 2:751. A very small-leaved form, but var. **lineata** is still smaller, and has the smallest lvs. of all. 10. Var. **myrtifòlia**, Hort. Lvs. ovate-lanceolate, 1-1½ in. long, moderately spiny, rarely entire. G.C. II. 2:687. 11. Var. **serratifòlia**, Loud. Lvs. ovate-lanceolate, stiff, with numerous small spiny teeth. G.C. II. 2:687.

(bb.) *Lvs. all or most of them without spines.*

12. Var. **heterophýlla**, Loud. Lvs. oval or elliptic-ovate, about 2½ in. long, sometimes twisted near the apex, entire or with few spiny teeth. G. C. II. 2:519. 13. Var. **laurifòlia**, Loud. Lvs. ovate to elliptic-lanceolate, 2-3 in. long, usually quite entire. 14. Var. **marginàta**, Loud. Lvs. broadly ovate, sometimes twisted near the apex, with thickened entire margin. G. C. II. 2:813. 15. Var. **Scótica**, Hort. Lvs. oval-obovate, blunt and rounded at the apex, rarely pointed, 1½-2 in. long, with thickened, wavy entire margin. G. C. II. 2:813. 16. Var. **tortuòsa**, Hort. (var. *críspa*, Hort.). Lvs. oval and spirally twisted, with revolute margin, entire or with few spines, about 2 in. long: of dense habit. G.C. II. 2:813.

(aa.) *Foliage variegated.*

(b.) *Lvs. spiny-toothed.*

17. Var. **álbo-marginàta**, Loud. (var. *argenteo-marginàta*, Hort.). Lvs. broadly ovate, to 2½ in. long, with numerous irregular spines, dark green, the disk mottled with grayish green, with rather narrow silvery margin. 18. Var. **albo-pícta**, Loud. (var. *argenteo-medio-pícta*, Hort.). Lvs. ovate, with divaricate spines, dark green, with a whitish center and a narrow, irregular, silvery margin. G.C. II. 4:687. 19. Var. **aùreo-maculàta**, Hort. Lvs. oblong-oval, 2½ in. long, with distant triangular, somewhat divaricate spines, with a large creamy white blotch in the center, outer part of the margin dark green, inner part mottled pale gray. 20. Var. **aùreo-regìna**, Hort. (var. *aurea marginàta* and var. *latifolia marginàta*, Hort.). Lvs. broadly ovate, to 3 in. long, with strongly divaricate spines, mottled with gray and green, with a broad, continuous golden yellow margin. G.C. II. 5:44. 21. Var. **aùreo-picta latifòlia**, Hort. Lvs. ovate or broadly ovate, 2 in. or more long, with a large, branching, deep yellow blotch in the middle, and with an irregular, deep glossy green margin. G.C. II. 5:624. 22. Var. **fèrox argéntea**, Loud. Like var. *ferox*, but the margin and the surface spines creamy white. G. C. II. 5:44. 23. Var. **fèrox aùrea**, Loud., is like the former, but with yellow spines and margin.

1123. Ilex aquifolium. (×⅓.)

1124. Ilex opaca. (×⅓.)

(bb.) *Lvs. spineless or mostly so.*

24. Var. **heterophýlla aureo-picta**, Hort. Lvs. ovate, flat, sometimes with few spines, about 2½ in. long, marked in the middle with a broad feathery blotch of bright yellow. G. C. II. 6:389. 25. Var. **Scótica aurea**, Hort. Lvs. obovate, blunt, slightly wavy, about 1½ in. long, dark, mottled green, with a broad golden margin: of dwarf habit. 26. Var. **Wateriàna**, Hort. Lvs. oblong or ovate, with a few spines, or entire and plain and obtuse, about 2 in. long, mottled with gray and yellowish green and edged with a broad, irregular golden band. G.C. II. 6:233.

There are also some other vars., as, 27, var. **fructu lùteo**, with yellow, and 28, var. **fructu aurantiaco**, with orange berries; 29, var. **péndula**, with pendulous branches and 30, var. **pyramidàlis**, with ascending branches, forming a narrow, oblong head.

31. **cornùta**, Lindl. Shrubby, with short spreading branches, glabrous: lvs. oblong, with 3 strong spines at the dilated apex, and with 1-2 strong spines on each side of the truncate base, but rounded and spineless at the base on older plants, dark glossy green above, 2-4 in. long: fr. scarlet, clustered, short-pedicelled. June, July. N. China. P.F.G. 1, p. 43. G.C. 1850:311. F.S. 7, p. 216; 9:895. B.M. 5059.

CC. *Fls. in 1-few-fld. axillary, peduncled cymes, on this year's growth.*

32. **opàca**, Ait. (*I. quercifòlia*, Meerb.). AMERICAN HOLLY. Fig. 1124. Tree, with spreading short branches,

sometimes to 50 ft., forming a narrow, pyramidal head, glabrous: lvs. oval or elliptic-lanceolate, with large remote spiny teeth, rarely entire, dull green above, yellowish green beneath, 2–4 in. long: fr. dull scarlet, usually solitary, globose. June. Mass. to Fla., west to Mo. and Tex. Em. 385. S. S. 1:45. Gng. 4:277.—Hardier than *I. Aquifolium*, but less handsome.

BB. *Lvs. serrate, crenate or entire.*

C. *Fr. red: nutlet ribbed on the back. Tender.*

33. **Cassine,** Linn. (*I. Dahoòn*, Walt.). DAHOON. Shrub or small tree, to 30 ft.: lvs. obovate to oblong-linear, acute or obtuse and mucronulate, entire or sharply serrate above the middle, usually pubescent beneath when young, 2–3 in. long: fr. globose, small, dull red, rarely yellow, on this year's growth. April, May. N. C. to Fla., west to La. S. S. 1:46. 34. Var. **angustifòlia,** Ait. Lvs. linear-oblong to linear, 2–3 in. long. 35. Var. **myrtifòlia,** Chapm. Lvs. linear-oblong, 1–2 in. long: fr. usually solitary. S.S. 1:45.

36. **latifòlia,** Thunb. Tree, sometimes to 60 ft., glabrous: lvs. oval to oblong-lanceolate or obovate-oblong, serrate, glossy green above, 3–7 in. long: fr. red, large, in almost sessile clusters. June. Japan. B.M. 5597. P.F.G. 3, p. 13.—One of the most beautiful Hollies.

37. **vomitòria,** Ait. (*I. Cassine*, Walt., not Linn.). CASSENA. YAUPON. Shrub, rarely tree to 25 ft., with spreading branches: lvs. oval or oblong, obtuse, crenate, glabrous, ½–1, rarely to 2 in. long: fls. clustered on branches of the previous year: fr. scarlet, globose, small. April. Va. to Fla., west to Ark. and Tex. S.S. 1:48.

1125. Ilex verticillata. (×½.)

CC. *Fr. black: nutlets smooth: pistillate fls. usually solitary, on this year's growth.*

38. **crenàta,** Thunb. (*I. Fórtunei*, Hort.). Much-branched shrub, rarely small tree to 20 ft.: lvs. oval, obovate or oblong-lanceolate, crenately serrate, glabrous, ½–1½ in. long: fls. 4-merous. May, June. Japan. Gng. 6:165.

39. **glàbra,** Gray (*Prìnos glàber*, Linn.). INKBERRY. WINTERBERRY. Much-branched upright shrub, to 8 ft.: lvs. obovate to oblanceolate, obtuse, with few obtuse teeth toward the apex, glabrous, 1–2 in. long: fls. 5–8-merous. June. Mass. to Fla., west to Miss. L.B.C. 5:450.

AA. *Foliage deciduous: fr. red.* (*Prinos.*)

B. *Frs. mostly and lvs. partly fascicled on short spurs: nutlets ribbed on the back.*

40. **decidua,** Walt. (*Prìnos deciduus*, DC.). Shrub or small tree, to 30 ft., with light gray spreading branches: lvs. cuneate-oblong or obovate, usually obtuse, crenately serrate, dark green, and with impressed veins above, pale and pubescent beneath, 1½–3 in. long: fr. globose, orange or orange-scarlet, ½ in. across. May. Va. to Fla., west to Texas. S.S. 1:49.

41. **monticola,** Gray (*Prìnos dùbius*, Don). Tree, to 40 ft., with slender branches, forming a narrow pyramidal head or spreading shrub: lvs. oval or oval-lanceolate, acute or acuminate, sharply serrate, pubescent only along the veins beneath, 2–6 in. long: fr. red, globular-ovoid, ½ in. across. May. N.Y. to S. C., west to Ala. S.S. 1:50. G.C. II. 14:689 (as *I. decidua*). 42. Var. **móllis,** Britton (*I. móllis*, Gray). Lvs. broadly ovate, soft-pubescent when young, glabrous above at length.

BB. *Frs. and lvs. not fascicled: frs. axillary: nutlets smooth.*

43. **lævigàta,** Gray (*Prìnos lævigàtus*, Pursh). WINTERBERRY. Low shrub, of upright habit: lvs. lanceolate, acute, finely or crenately serrate, rather thick, glabrous or nearly so, 1½–2½ in. long, turning clear yellow in fall: fls. 6–9-merous: fr. depressed-globose, bright orange-red, over ¼ in. across. May, June. Maine to Pa. and Va. G.F. 4:221.

44. **verticillàta,** Gray (*Prìnos verticillàtus*, Linn.). BLACK ALDER. WINTERBERRY. Fig. 1125. Shrub, with spreading branches: lvs. obovate to oblanceolate or lanceolate, acuminate or acute, serrate or doubly serrate, usually pubescent beneath, 1½–3 in. long, turning black after frost: fls. 5–6-merous: fr. bright red, rarely yellow, about ¼ in. across. June, July. Canada to Fla., west to Wis. and Mo. Em. 388.—Very variable in shape and texture of lvs. One of the best hardy shrubs, with ornamental frs., which remain on the branches until midwinter, and are not eaten by birds.

45. **serràta,** Thunb. Slender shrub, to 15 ft., similar to the former but smaller in every part: lvs. elliptic or ovate, acute or acuminate, finely serrate, pubescent or glabrous beneath, 1–2 in. long: fls. 4–6-merous: fr. bright red, small, one-sixth to one-fifth in. across. June. Japan. There are two forms of this species: both have been introduced from Japan as *I. Sieboldi*, the first by Prof. Sargent, the second by Thomas Hogg. 46. Var. **argùtidens,** Rehder (*I. argùtidens*, Miq.). Lvs. glabrous beneath, short-petioled, teeth more remote and less fine: fls. usually 4-merous. 47. Var. **Sièboldi,** Rehder (*I. Sièboldi*, Miq.). Lvs. somewhat larger, longer-petioled, more finely serrate, pubescent beneath: fls. usually 5-merous.

I. ambigua, Chapm. Deciduous large shrub, allied to I. monticola. Lvs. usually almost glabrous, remotely serrate, 1–2 in. long. N. C. to Fla., west to Ark. and Tex.—*I. Amelánchier*, M. A. Curtis. Deciduous shrub, to 6 ft.: lvs. oblong, subacute, serrate, pubescent, 1½–3 in. long: fr. dull red, large. Va. to La. G.F. 2:41. Hardy.—*I. Califórnica*, Brandegee. Evergreen large shrub, to 12 ft., glabrous: lvs. elliptic to oblong-elliptic, obtuse, remotely and crenately serrulate, 2–5 in. long: fr. black, small. Calif. G.F. 7:415 (by error named I. triflora).—*I. Canariénsis*, Poir. Evergreen tree, to 20 ft., glabrous: lvs. ovate to ovate-oblong, obtuse, entire, 2–4 in. long: fr. usually solitary, on this year's growth. Canar.—*I. conocárpa*, Reiss. Evergreen shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, serrulate glabrous, 3–5 in. long: fls. in short, dense spikes: fr. ovoid-conic. Brazil. B.M. 7310.—*I. coriácea*, Chapm. (I. lucida, Torr & Gr.). Allied to I. glabra, but taller: lvs. broader and longer, to 3 in., acute or acuminate. N. C. to Fla., west to La.—*I. dipyrèna*, Wall. Evergreen tree, to 40 ft.: lvs. elliptic to lanceolate, remotely spiny-serrate, sometimes entire, glabrous, 2–4 in. long: fr. scarlet, globose, clustered. Himal.—*I. dùbia*, B. S. P.—I. monticola.—*I. Gongónha*, Mart.—Villaresia mucronata.—*I. insignis*, Hook. f. Evergreen small tree: lvs. elliptic-lanceolate, 6–9 in. long, spiny-toothed, often almost entire on older plants: fr. large, globose. Himal. G. C. II. 14:297.—*I. integra*, Thunb. Evergreen large shrub or tree, to 40 ft.: lvs. obovate, obtusely pointed, entire, 3-4 in. long: fr. large, rather long-peduncled, red. Japan.—*I. lóngipes*, Chapm. Deciduous shrub, allied to I. decidua: lvs. elliptic-lanceolate, crenately serrate, almost glabrous: fr. globose, slender-pedicelled. N. C. to Ga., west to La. G. F. 3:345.—*I. microcárpa*, Lindl. = rotunda, Thunb.—*I. Paraguariénsis*, St. Hil. (I. Paraguayensis, Auth.). MATÉ. PARAGUAY TEA. Shrub, to 15 ft.: lvs. obovate, obtuse, obtusely serrate, 2-5 in. long, glabrous: fr. small, peduncled. Brazil.—*I. Peràdo*, Ait. (I. platyphyllos, Webb. & Berth.). Evergreen pyramidal tree, to 20 ft., glabrous: lvs. broadly ovate or obovate to oblong, entire, serrate on young plants, 2-5 in long: fr. large, red, clustered, short-pedicelled, on last year's growth: Canar. L.B.C. 6:519. B.M. 4079.—*I. rotúnda*, Thunb. (I. microcarpa, Lindl.). Evergreen shrub or tree, to 40 ft.: lvs. oblong or elliptic, acute, pointed, quite entire: fr. small, red, in peduncled clusters. Japan. P.F.G. 1, p. 43. G.C. 1850:311. F.S. 7, p. 216.—*I. rugòsa*, F. Schmidt. Evergreen low spreading shrub, sometimes prostrate, glabrous: lvs. oblong-lanceolate to lanceolate, remotely crenate-serrate, rugose above, ¾-2 in. long: fr. usually solitary, scarlet. Japan, Sacchalin.—*I. triflòra*, Brandegee. Evergreen tree, to 40 ft., with spreading pubescent branches: lvs. elliptic-lanceolate, remotely serrate or almost entire, pubescent, 2-3½ in. long: fls. 5-merous. Calif. G.F. 7:416 (by error named I. Californica).

ALFRED REHDER.

ILLÍCIUM (Latin for *allurement;* probably in reference to the agreeable odor). *Magnoliàceæ.* A half dozen species in Japan, China, India and eastern N. America. Small trees or shrubs, glabrous, with thick, short-petioled entire evergreen lvs.: fls. small, solitary or in 3's in the axils of lvs. or bud-scales, nodding or inclined, yellow or purplish; sepals 3-6; petals many, imbricated in 3 or more rows or series; stamens 10-many, with thick filaments: carpels usually many, forming a ring of almost woody pods. The Illiciums are aromatic plants with perfect fls.

One of the Illiciums furnishes the Star or Chinese Anise, which is the small star shaped cluster of fruits. The odor and flavor strongly resemble Anise. It is much used in oriental countries in cookery, and is exported to some extent and is said to be used in flavoring certain French wines. This product comes from China. It has been supposed to be the product of *I. anisatum* of Linnæus, but that plant is a Japanese tree and it contains a poison. In the American trade are the names *I. anisatum* and *I. religiosum.* It now transpires that these names belong to the same plant, and that the Star Anise is produced by another species. This other species, or the true Star Anise, was first accurately described and figured (as *I. verum*, Hook. f.) in B.M. 7005 (1888), where the confusion of two or three centuries is elucidated. There is probably only one East Asian Illicium in the trade in N. Amer., as follows:

anisàtum, Linn., not Gærtn. (*I. religiòsum*, Sieb. & Zucc.). Small tree: lvs. alternate, elliptic, short-petioled, somewhat acuminate: fls. mostly solitary, sessile or nearly so, yellowish, not fragrant, with many very narrow petals, and 20-30 stamens. Japan. B.M. 3965.—Grown far S. There is a form with variegated lvs.

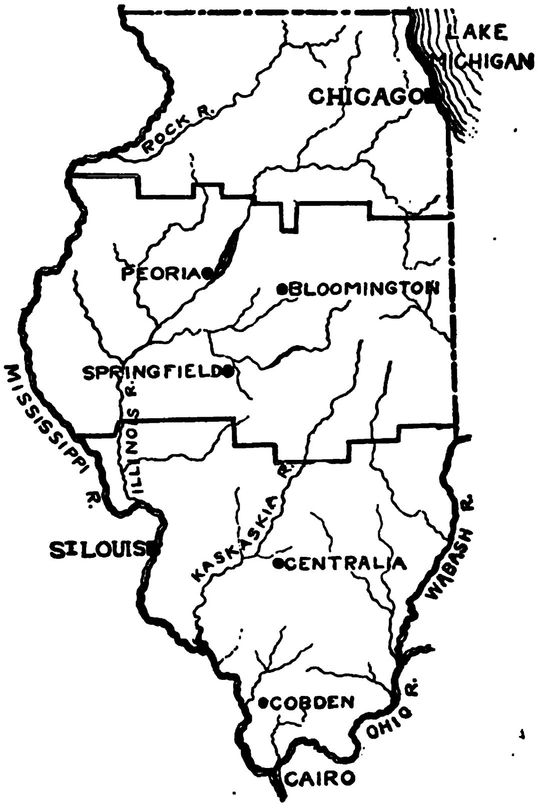
Two native Illiciums growing in the Gulf country are: *I. Floridànum*, Ellis. Shrub, 6-10 ft.: lvs. oblong-lanceolate, 4 in. or more long: petals 20-30, very narrow, dark crimson. B.M. 439. Gn. 36, p. 151. J.H. III. 30:365.—*I. parviflòrum*, Michx. Lvs. elliptic or lanceolate, mostly under 4 in. long: petals very small (¼ in. long), 6-11, yellowish.

L. H. B.

ILLINOIS, HORTICULTURE IN. Fig. 1126. The state of Illinois, lying in the heart of the Mississippi valley, the most fertile portion of the United States, and with its eastern boundary over 700 miles from the Atlantic coast, has a range north and south of a little over 350 miles, extending from 37° to 42° 30′ north latitude, and a breadth east and west of about 200 miles at its widest point. In spite of its great length, the difference in mean annual temperature between the extreme northern and southern parts of the state is only 10° F., although the rainfall in the southern part is one-half greater than in the northern.

Soil conditions alone considered, Illinois stands, agriculturally, at the very forefront. Third among the states of the Union (1890) in population, and first in railroad mileage, it is also first in total bulk of agricultural and horticultural products. There are no considerable tracts of worthless land in the state; and the statistics collected by the State Board of Agriculture show every one of the 102 counties of the state to be fruit-producing. The statistics of the census of 1890 showed Illinois at that time to be easily third in rank among the horticultural states.

The horticultural interests of Illinois have been well looked after and carefully placed on a permanent basis by the legislature. In 1874 an act was passed by that body establishing the Illinois State Horticultural Society (which was organized in 1855) as a public corporation of the state. The State Horticultural Society is divided into three subdivisions, the Northern, Central and Southern Illinois Horticultural Societies, each taking in about one-third of the state (see map). The State Horticultural Society has been liberally supported by the legislature since its foundation, and is in a flourishing condition.



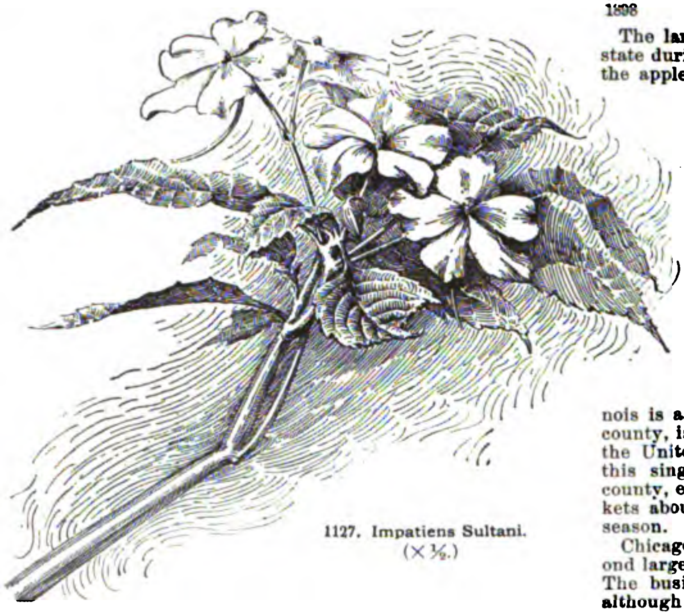
1126. Illinois.
Showing three horticultural divisions, following county lines.

The most distinctive fruit section of Illinois is the southern third. This area contains something over 150,000 acres devoted to the growing of apples alone. Other deciduous fruits, notably peaches and pears, and small fruits, especially strawberries, are also grown in large quantities in this part of Illinois. During the season of 1898 over 800 car-loads of strawberries alone were shipped to outside markets from the fruit districts of southern Illinois. Increased shipping facilities and the coming into bearing of orchards already some time planted are rapidly bringing southern Illinois into competition with Michigan in the production of peaches.

The southern fruit district, as indicated on the map, lies between 37° and 39° 30′ north latitude, the former being the latitude of Norfolk, Va., and the latter that of Baltimore, Md. The climate of this district is best indicated by the fact that the isotherm 55° F. passes through the northern part of the district, the same temperature line also passing through the peach and sweet potato districts of Delaware and southern New Jersey. The 50° isotherm passes through Illinois about on the dividing line between the northern and central fruit districts, thus showing the mean annual temperature of the northern district,—which is second to the southern in small-fruit production, and in 1898 produced more grapes than both the other districts put together,—to be practically the same as that of the great grape and small fruit sections of central New York. While speaking of temperature it should also be noted that the mean annual temperature of the famous Santa Clara valley and the Santa Cruz mountain wine grape district of California is 55° F., or about that of Madison and Bond counties, Illinois.

In 1898 the total annual precipitation at Galena, in the extreme northwest corner of the state, was 30 inches; in Henderson county and from thence along a line a little north of east clear across the state, 40 inches; in a circle taking in Adams, Pike, Fulton, Tazewell, Menard and Morgan counties, and along a line entering the state in Monroe county, bending north almost as far as Springfield, and thence southeast to Lawrence county, 50 inches; and in the 12 or 14 extreme southern counties of the state, 60 inches. The mean annual rainfall for 10 years up to and including 1898 at the Illinois Agricultural Experiment Station at Urbana, Champaign county, was nearly 33⅝ inches.

Products.—An idea of the extent of the horticultural interests of Illinois can be best gained by reference to the following tables, which give the approximate production of the various horticultural crops raised in the state for five years, down to and including 1898:



1127. Impatiens Sultani. (× ½.)

Orchard Fruits—*Annual Crop in Bushels.*

APPLES.

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	305,057	1,704,338	533,403	2,542,798
1895	365,908	2,287,731	4,737,027	7,390,666
1896	361,754	1,890,464	2,404,441	4,656,659
1897	520,775	2,871,040	5,164,672	8,556,487
1898	136,154	227,050	670,280	1,033,484

PEACHES.

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	869	13,247	49,582	63,698
1895	6,063	23.173	169,576	198,812
1896	8,135	20,704	141,174	170,013
1897	2,387	11,075	230,816	244,278
1898	8,912	10,750	193,730	213,392

PEARS.

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	313	1,845	3,007	5,165
1895	275	1,528	14,194	15,997
1896	434	1,251	12,191	13,876
1897	192	1,090	13,773	15,055
1898	223	885	10,177	11,285

Grapes—*Annual Crop in Pounds.*

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	603,638	658,908	467,813	1,731,069
1895	198,888	459,916	410,839	1,069,643
1896	248,151	467,877	263,990	960,018
1897	449,833	573,832	239,807	1,263,472
1898	715,592	435,544	201,807	1,352,943

Strawberries—*Annual Value of Crop.*

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	$14,309	$4,037	$25,019	$43,365
1895	5,556	1,985	3,458	10,999
1896	7,407	3,805	14,910	26,122
1897	14,362	3,864	24,374	42,600
1898	17,840	3,929	24,080	45,849

Watermelons—*Annual Value of Crop.*

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	$24,021	$28,963	$2,128	$55,112
1895	20,231	18,116	11,710	50,057
1896	23,215	16,217	8,435	47,121
1897	21,497	16,451	8,276	46,224
1898	20,773	16,103	8,261	45,137

Other Fruits and Berries—*Annual Value of Crop.*

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	$28,190	$36,930	$42,364	$107,484
1895	17,532	30,915	114,560	163,007
1896	18,196	22 586	80,733	121,515
1897	21,175	25,775	110,249	157,199
1898	25,807	26,452	84,186	136,445

Sweet Potatoes—*Annual Crop in Bushels.*

Year.	Nor. Div.	Cent. Div.	Sou. Div.	Total.
1894	7,901	85,321	235,704	328,926
1895	18,409	80,231	200,220	298,860
1896	25,408	67,147	210,790	303,345
1897	10,003	49,596	132,703	192,302
1898	12,633	67,327	280,156	360,116

The large falling off in the apple production of the state during the season of 1898 was due to a scourge of the apple-scab fungus, which attacked and devastated the apple orchards in all parts of the state. Pear-growing in southern Illinois has been more or less kept back by the prevalence of pear blight, which has destroyed many trees before coming into bearing. No comment on the other tables is necessary, as they tell their own story.

The nursery industry has been largely developed in Illinois. There are 447 commercial nurseries in the state, 203 in the northern division, 143 in the central, and 101 in the southern. The other branches of horticultural industry are also well developed in the state. Gardening for the Chicago market forms a large and important business in itself; while the growing of vegetables for shipment in certain sections of southern Illinois is assuming large proportions. Cobden, in Union county, is the largest shipping point for tomatoes in the United States, sending out some 300 car-loads of this single fruit during the season of 1898. Union county, exclusive of Cobden, shipped to outside markets about 400 car-loads of tomatoes during the same season.

Chicago was, according to the census of 1890, the second largest market in the United States for cut-flowers. The business has grown considerably since that time, although exact figures are not obtainable. The only notable examples of landscape horticulture or landscape gardening in the state are found in the Chicago city park system, which is the largest and in some respects the finest in the entire country.

With her situation, natural advantages, vast resources and present attainments along these lines, Illinois seems destined to take even higher rank horticulturally in the not far distant future than she has in the past; and with her increasing production and immense and growing railway facilities, to prove a formidable rival to the older fruit-producing regions of the Union.

The tables giving crop reports are compiled from figures given in the annual statistical reports of the Illinois State Board of Agriculture. Other figures (except where noted as being from census report) are from the Report of the Illinois State Farmers' Institute for 1898. The climatic and meteorological information is based on reports of the United States Weather Bureau and records of the Illinois Agricultural Experiment Station.

J. C. Blair.

IMANTOPHÝLLUM. Included under *Clivia*.

IMMORTELLES. Consult *Everlasting Flowers*.

IMPÀTIENS (from the Latin; having reference to the pods, which, when ripe, on slight pressure burst open, scattering the seed). *Geraniàceæ*. (By some referred to *Balsaminàceæ*.) Tender, succulent herbs, with very fleshy stems and simple leaves usually alternate and the upper ones often in whorls: peduncles axillary, with 1–6 or more fls. of various colors: sepals 3 (seldom 5), the posterior one taking on a spur-like shape; petals 5 or 3, in which case 2 are grown together: fr. a pod, which, when ripe, bursts when pinched, scattering the seeds. About 220 species, mainly from tropical India and Africa. About 20 have found their way into cultivation for the most part as greenhouse plants, *I. Balsamina* being the species best known as an outdoor annual. See *Balsam*. Propagation by cuttings and seed.

A. *Peduncles with single fls.*

Háwkeri, W. Bull. A bushy, soft-wooded plant with well branched stems of a dull red color; lvs. opposite or in whorls of 3, ovate, acuminate, serrate, dark green: peduncles axillary, long and slender: fls. rounded in outline, about 3 in. in diam., deep carmine, with a white eye. South Sea Islands. Int. about 1886. G.C. II. 25:761. I.H. 34:2.—A greenhouse plant, needing an intermediate temperature. Plants from early spring cuttings bloom all summer and into autumn.

platypétala, Lindl. (*I. pulchérrima*, Dalzell. *I. latifòlia*, Hort.). Stems strong, succulent, branched and usually reddish purple: lvs. whorled, lanceolate or oval, serrate, hairy beneath: peduncles axillary, shorter than the lvs.: fls. large, rose-colored: spur sickle-shaped, rather thin and petals transversely obcordate. Summer. Java. R.H. 1847:221. B.R. 32:68.—Needs a moderate to warm temp., and may be used as a house-plant or in protected and warm situations outdoors. Prop. by cuttings, and during growth should be treated like Gloxinias. Var. Lucie or Lucy belongs here.

1128. Impatiens aurea (X ½.)
One of the native jewel-weeds.

AA. *Peduncles with 1–2 fls.*

Sultáni, Hook. Fig. 1127. From 12–24 in. high, with stout stem and branches, rather succulent and green: lvs. elliptical or lanceolate and narrowed into a petiole about 1 in. long; lower lvs. alternate, upper ones almost whorled: peduncles axillary, of a rich rose-red in the original form. Hybrids and sports have given shades from pink to almost purple, and a white variety also exists. Spur is very long and thin. Zanzibar. B.M. 6643. Gn. 23, p. 331. V. 7:325, 326. S.H. 2:280. I.H. 30:488; 42, p. 140. R.H. 1884:12.—Increased by seeds; also by cuttings, which root readily. With *I. Hookeriana*, the best in cult. A greenhouse plant; it also does well as a house plant, blooming almost continuously.

1129. Impatiens Roylei (X ⅙).

AAA. *Peduncles with 2–4 fls.: plant 2–4 ft.*

aùrea, Muhl. (*I. pállida*. Nutt.). PALE TOUCH-ME-NOT. JEWEL-WEED. Fig. 1128. With *I. biflora* the representatives of the family in the indigenous flora of the U. S. Larger than *I. biflora;* otherwise similar to it, with pale yellow fls. sparingly dotted with brownish red; spur short, notched, and less than one-third the length of the posterior sepal. Moist, shady places. July–Sept. Quebec to Ore., Kans. and Ga. B.B. 2:404.—Procurable from dealers in native plants.

biflòra, Walt. (*I. fúlva*, Nutt.). SPOTTED TOUCH-ME-NOT. JEWEL-WEED. With *I. aurea* representing the genus in the U. S. An annual with orange-colored fls., mottled with reddish brown: spur strongly inflexed, about half as long as posterior sepal. Moist, shady places. July–October. Nova Scotia to Alaska, Ore., Mo. and Fla. B.B. 2:403. D. 155.—Has been offered by dealers in native plants.

Balsámina, Linn. (*Balsámina horténsis*, DC.). GARDEN BALSAM. See Vol. I, p. 126.

AAAA. *Peduncles with 3–6 or more fls.*

Hookeriàna, Arn. (*I. biglandulòsa*, Moon. *I. Sultáni álba*. Hort.). A very succulent much-branched plant, growing to a height of 3 ft.: lvs. long-petioled, ovate-lanceolate, toothed: peduncles axillary in the upper lvs.: fls. large, white, spotted with purple on the large lower petals; spur bent horn-shaped, and longer than the fls. Blooms in fall. Ceylon. B.M. 4704.—It is a perennial, requires a moderate temp., and does not bloom until well developed. Prop. by cuttings. One of the best species in cult.

Róylei, Walp. (*I. glandulígera*, Royle). Fig. 1129. A rather coarse garden annual, with strong stem, succulent and much-branched: lower lvs. opposite; upper lvs. usually in 3's and whorled, all ovate or ovate-lanceolate, naked, 4 in. long, sharply serrate; basal serrations and the petiole glandular: peduncles axillary, with 3 or more fls. and very numerous toward top of plant: fls. large, dark purple; spur very short. Aug., Sept. India. B.M. 4020. B.R. 26:22.—Grown from seed, needing but little care, and useful in groups.

G. N. LAUMAN.

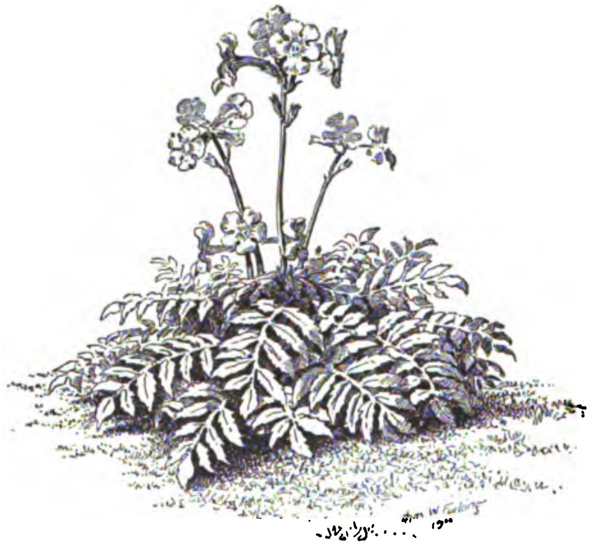
IMPHEE. See *Sorghum*.

INCARVÍLLEA (after Incarville, the French Jesuit missionary to China). *Bignoniàceæ.* About 10 species of herbaceous perennials from central Asia, one of which, *I. Delavayi*, has achieved extraordinary notice since 1893. It is a hardy plant with handsome pinnate foliage, each leaf being 1 ft. long, with as many as 15–20 dentate segments: scape 1–2 ft. high, bearing 2–12 large trumpet-shaped, rosy purple fls., each 2–3 in. long and as much wide. These fls. are probably equal in decorative value to many of the Bignonias cherished in our greenhouses. In size and beauty they rank with those of Catalpa, Bignonia and Tecoma, of the same family. This species is certainly the finest hardy herbaceous perennial in the Bignonia family. The tube is yellow inside and out, and the 2 upper lobes are smaller than the 3 lower ones. The genus is closely allied to Amphicome, and the flowers of both have the same general appearance, but in Incarvillea the calyx lobes are awl-shaped, while in Amphicome the calyx is truncate or shortly dentate. Also the seeds of Incarvillea have an entire hyaline wing, while in Amphicome the seeds have a wing that is cut into long thin, strips or hairs. The two genera form a small but remarkable group, characterized by their capsules opening by the ventral suture only. William Watson declares that Incarvilleas are not annuals, as stated in the botanies.

The general experience seems to be that these plants need rather more winter protection than most hardy herbaceous perennials. A light, sandy loam, well enriched and deeply worked, suits them well, and they like a sheltered position in a rather warm, sunny place. Prop. by division or seed.

A. *Segments toothed from base to apex.*

Delavàyi, Bur. & Franch. Fig. 1130. Lvs. few, radical; lfts. 4–5 in. long, not quite opposite: stamens included. B.M. 7462. Gn. 54:1198. R.H. 1893:544. J.H. III. 30:449. Gt. 43:1398. Mn. 3, p. 26. G.C. III. 26:659. G.M. 38:306.



1130. Incarvillea Delavayi.

AA. *Segments parted or dissected.*

variábilis, Batalin. Subshrub: lvs. 2- or 3-pinnate; segments parted or dissected, their lobes entire or slightly lobed: fls. as many as 10, pale rose. Gt. 47, p. 222.—Int. 1898 by Haage and Schmidt, who say that it makes a strong-growing, bushy plant covered with fls. each 1 in. or more across, from May to Oct.: also that seedlings bloom the first year.

AAA. *Segments often entire or nearly so.*

B. *Form of segments lanceolate or narrower.*

Ólgæ, Regel (*I. Koòpmannii*, W. Lanche). Subshrub, 2–3 ft. high: lvs. 2–4 in. long; segments linear-oblong or lanceolate, narrower than in *I. Delavayi*, especially at the base, entire or with a few distant teeth towards the tip: fls. pale pink, veiny; tube 1½ in. long; limb about 1 in. across, the 5 lobes nearly equal. B.M. 6593 (throat not yellow). G. C. II. 19:89. Gn. 28, p. 653.—The hardiest species.

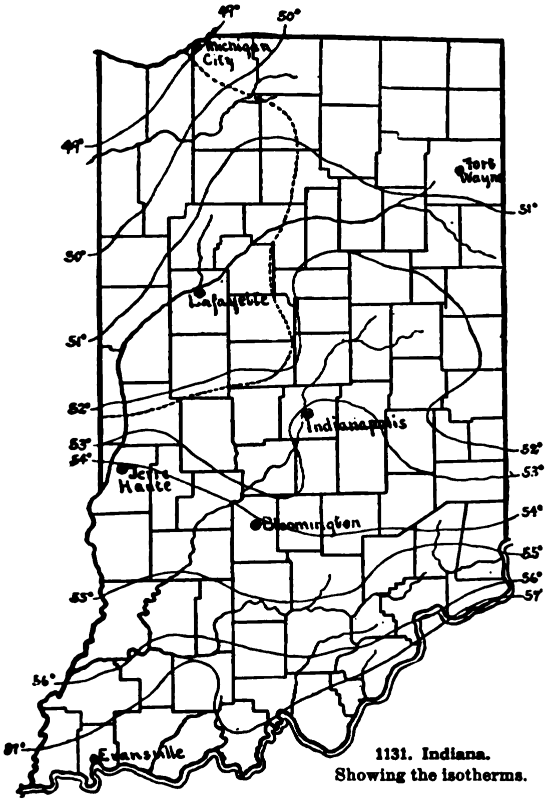
BB. *Form of segments ovate or broader.*

grandiflòra, Bur. & Franch. Differs from *I. Delavayi* in its shorter lvs., more rounded lfts., short scapes bearing only 1 or 2 fls. as large as those of *I. Delavayi*, but with narrower calyx lobes and longer corolla lobes. the color deep rose-red. Dried specimens show about a dozen scapes on a plant. China. Gn. 56:1230.—Int. about 1898. Imperfectly known, and may be a form of *I. compacta*. *I. grandiflora*, Poir.=*Tecoma grandiflora*. *I. grandiflora*, Spreng.=*Æschynanthus grandiflora*.

J. B. Keller and W. M.

INDIANA, HORTICULTURE IN. Fig. 1131. Indiana is essentially a fruit-growing state. There is no part of its soil that cannot be made suitable for the production of fruit of some kind. There are portions, however, that are better adapted to the growing of wheat and corn or grazing on account of the prairie character of the soil, or the climatic conditions, which render the cultivation of orchard fruits a precarious business. By referring to the accompanying map, it will be seen that the mean annual isotherms for the year 1898, and the same will hold approximately for a series of years, are decidedly irregular in the northern part of the state, while in the southern half they run more uniformly across the state. This is caused very largely by the ameliorating influence of Lake Michigan, which is felt very perceptibly along the northern counties which are protected from the severe northwest winds; but it is not felt in any appreciable degree as we go down the western side of the state. And so it often happens that the temperature falls lower 75 miles south of Lake Michigan than it does in the counties bordering on Michigan. This difference is often great enough to render peach growing in this section, as a commercial business, out of the question. From the northeastern portion of the state south to the Ohio river, and covering all that territory not already mentioned, the climate is not so severe, and fine crops of peaches are often produced. The dotted line, shown on the map, starting near Michigan City and running in an irregular line, taking in most of the famous Kankakee marshes, thence in a southerly and westerly direction. finally striking the west line of the state a little north of Terra Haute, is intended to indicate, approximately, that portion of the state that is better adapted to the growing of general farm crops than fruit. This is not wholly due to climatic causes, but in a large degree to adverse soil conditions. A large part of this region is flat prairie land; much of it was once covered with marshes, but with modern drainage facilities nearly all of this naturally fertile land has been improved until it has become one of the best farming sections in the state. Only occasional spots, however, are high enough for orchard purposes; but small-fruits and vegetables grow with the greatest luxuriance, and large quantities of these are shipped to the Chicago market. A region in the Kankakee valley, including Starke and adjoining counties, is famous for its sugar beet productions. The soil here is of a sandy nature, eminently adapted to the culture of this vegetable; specimens have been analyzed which yielded 22 per cent of sugar, with a purity coefficient of 90 to 95. While there are not many large commercial orchards found in the northern and northeastern portions of the state, the soil and climate are admirably adapted to the growing of all kinds of orchard fruits. with the exception of peaches, which are grown only to a limited extent. Here we find a sandy or clay loam. with clay subsoil, which was originally covered with oak, maple, hickory, walnut and all kinds of hard woods found in this climate. The surface is more or less rolling, with numerous small lakes dotting the landscape. thus insuring both soil and atmospheric drainage. In the shallow waters of some of these lakes and marshes the cranberry finds congenial surroundings, and in the sandy districts of Pulaski, Fulton, Kosciusko and surrounding counties, the huckleberry grows to perfection.

In eastern Indiana the plum and the cherry are grown more largely than the peach, while the central part of the state excels in pears. Small-fruits are abundant everywhere.



1131. Indiana. Showing the isotherms.

Southern Indiana has a mean annual temperature 8° to 10° warmer than that of the northern end. With other favorable conditions in the way of soil, protection from severe winds and perfect atmospheric drainage, owing to the fact that the country for the most part is hilly, the peach and other tender fruits are successfully grown. Here, on the banks of the Ohio river, was, until recently, one of the largest peach orchards in the middle West; and even now orchards of from 40,000 to 50,000 trees may be seen on the "knobs" in Clark and Washington counties. Here, too, is the home of the "Big Red Apple" (Ben Davis) and the Kieffer pear. The largest Kieffer pear orchard may be seen near the town of Salem, in Washington county. This orchard consists of 12,000 trees. The soil in southern Indiana is for the most part decidedly different from that found farther north. In a report of the United States Geological Survey made some years ago, mention is made of the "white clay lands," which cover a large portion of southern Indiana, Ohio and Illinois, where most of the finest fruit is grown. In Indiana the northern boundary of this peculiar formation, according to the description, begins near Terre Haute on the west, and passes more or less irregularly across the state, passing into Ohio near Brookville, Franklin county. Thus the greater portion of the state south of this line is made up of this white clay deposit. In many places this clay becomes almost a brick-red, but the characteristics are, in general, the same, whatever the color. An apple orchard consisting of such varieties as Ben Davis, Rome Beauty, Winesap, Rall's Genet and Grimes' Golden, planted on these clays, is certain to reward the owner who gives it intelligent attention.

Here is also the home of the papaw, *Asimina triloba*, and the native persimmon, *Diospyrus Virginiana*. Excellent varieties of the latter are cultivated to some extent for the large markets, but the industry is as yet in its infancy. Both of these wild fruits offer a wide field for investigation. This section also includes the famous melon districts, where both musk- and watermelons are grown to perfection. Hundreds of acres are grown annually and the products shipped to the larger cities of the North and West. James Troop.

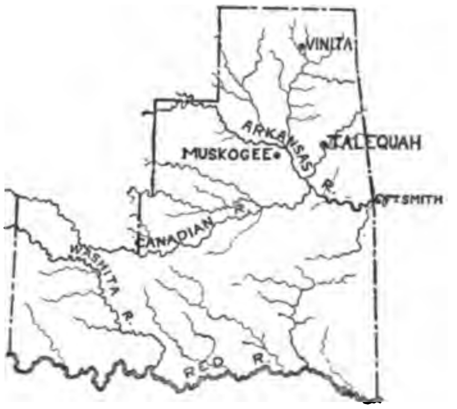
INDIAN BEAN. *Catalpa.* **I. Cherry.** *Rhamnus Caroliniana.* **I. Corn.** *Zea Mays.* See *Corn.* **I. Cress.** *Tropæolum.* **I. Cucumber-Root.** *Medeola Virginica.* **I. Currant.** *Symphoricarpos vulgaris.* **I. Fig.** *Opuntia vulgaris.* **I. Hemp.** *Apocynum cannabinum.* **I. Mallow.** *Abutilon* **I. Physic.** *Gillenia.* **I. Pipe.** *Monotropa.* **I. Rice** *Zizania aquatica.* **I. Shot.** *Canna.*

INDIAN TERRITORY, HORTICULTURAL POSSIBILITIES OF. Fig. 1132. The horticulture of the Indian Territory is in a very primitive state. The land is owned in common. The individual has the right to live on and occupy a certain piece of land for an indefinite length of time. The shipping facilities are poor. The local markets are very limited. The country is thinly populated. There is an abundance of wild fruit. The people are not sufficiently educated in agricultural industries to be successful in fruit culture.

There are soils of all kinds in the Territory. Most of the soil, however, is a sandy loam with a clay subsoil. Most of the land drained by the Arkansas and Canadian rivers is sandy. That drained by the Neosho and Verdigris is a black clay and limestone land with heavy clay subsoil. All the grades between these can be found on the borders of these river watersheds. In the extreme southern part some of the land is very low and wet.

Most of the country is rolling, and in extreme northeastern and south central part the hills almost reach the dignity of mountains. The Boston mountains (a spur of the Ozarks) run along the northeast border. The Washtaw hills extend through the southern part from east to west. The Flint hills enter the northwest part of the Territory, and are enclosed by the Arkansas and Verdigris rivers. From this it will be seen that but little of the country is flat or low and swampy, and the best of exposures for fruit land may be had in all parts of the country. There are no lakes or large bodies of water in the Territory.

The flora is about the same as that of Arkansas, although more limited in the western part. Few collections have been made, and only the plants of commercial importance are well known. The forest belts of Arkansas and Missouri extend for some distance into the Territory. Most of the timber is only second grade, composed of oaks, pine and walnut.



1132. Indian Territory.

Garden crops, where grown and cultivated, do well. Potatoes are grown to some extent for market in the Cherokee Nation, and give good returns. The early potatoes do best, but are very hard to keep over summer. Late potatoes yield well, but require more care in cultivation. Onions, beets, carrots, tomatoes and cabbage all produce good crops, but are not grown in commercial quantities. All of these vegetables promise to be money-makers in case of settlement of the country. Melons are grown here and shipped to neighboring markets with fair profits.

There are apple orchards in the Territory that have been in bearing for 15 years, and are still in fair condition. These orchards are usually near the Indian agencies or Mission schools, and are cared for by white people. When Oklahoma was first opened for settlement there were several wagon loads of apples taken to Guthrie and Oklahoma city, from the Creek Nation. These apples were of as good quality and as fine in appearance as apples shipped from Missouri and Kansas, and sold for a higher price. There are still a few apples taken each year from the Creek and Chickasaw Nations to the border towns of Oklahoma and sold for a good price. The fruit is the same quality as that grown in southern Missouri and northern Arkansas.

Few peach orchards have been planted, and these are mostly of seedling trees. The light open winters frequently cause the crop to be diminished or destroyed by the late spring frosts.

Plums seem to be perfectly at home here, and are almost a sure crop every year.

Grapes and berries are usually very free from disease, and bear heavily. The fruit is large, well developed and of a fine quality.

The soil and climate of Indian Territory are both very favorable to the production of fruit, and with permanent white settlement horticulture has a bright future within the borders of the Territory. O. M. Morris.

INDIAN TOBACCO. *Lobelia inflata.* **I. Turnip.** *Arisæma triphylla.* **I. Wheat.** *Fagopyrum Tataricum.*

INDIGO. See *Indigofera.* **False Indigo.** See *Baptisia* and *Amorpha.*

INDIGÓFERA (*indigo-bearing*). *Leguminòsæ.* Indigo. Perhaps 250 herbs or shrubs in many parts of the world. Lvs. odd-pinnate (rarely digitate): fls. usually small, in axillary racemes or spikes, in color ranging from purple to rose and white; standard mostly roundish, often persisting for some time: keel with a spur on either side: pod various, usually with thin partitions between the seeds. Several species are native to the United States.

Indigo is mostly the product of *I. tinctoria*, of Asia, but it is also made from the West Indian species, *I. Anil.* Other species, even of other genera, also yield Indigo. These species were early introduced into the southern states for Indigo-making, and the product was once manufactured to a considerable extent. The plant was introduced into South Carolina in 1742 from the West Indies. When it was found that commercial Indigo could be made, the British Government offered a bounty. In 1775, the production was more than one million pounds of Indigo. The war for independence checked the industry, and thereafter the rising importance of the cotton crop, amongst other things, drove it to the wall. But as late as the middle of the present century, Indigo continued to be made in remote places. Plants still persist in some places as escapes from cultivation. *Indigofera tinctoria* is perennial, but is grown from seeds, which give from two to four cuttings of herbage the first year. The Indigo is not contained in the plant, but the dye is a product of manufacture from a glucoside indican which is contained in the herbage, and which is obtained as an extract. Indigo seed is offered by seedsmen.

In North America, several species of Indigofera are occasionally grown as ornamental subjects. In the North, they are mostly greenhouse subjects. Propagated by seeds or cuttings, chiefly the latter.

AA. *Raceme as long as or longer than the leaf.*

décora, Lindl. Weak-growing or even half-climbing shrub, the branches slender and red-tinged: leaflets in 6-8 pairs, broad-lanceolate, usually drooping, sharp-pointed: racemes long, with showy rose-pink fls. about 1 in. long: standard oblong, nearly or quite obtuse. with a heart-like mark near the base: wings linear-lanceolate or spatulate, ciliate. China. B.R. 32:22. B.M. 5063. G.M. 31:591. P.M. 16:290.—Regarded as a greenhouse plant and cult. in the open far South. Var. **álba** is said (G.F. 7, pp. 266, 376, fig. 61) to be a hardy herbaceous or half-shrubby plant at the Arnold Arboretum.

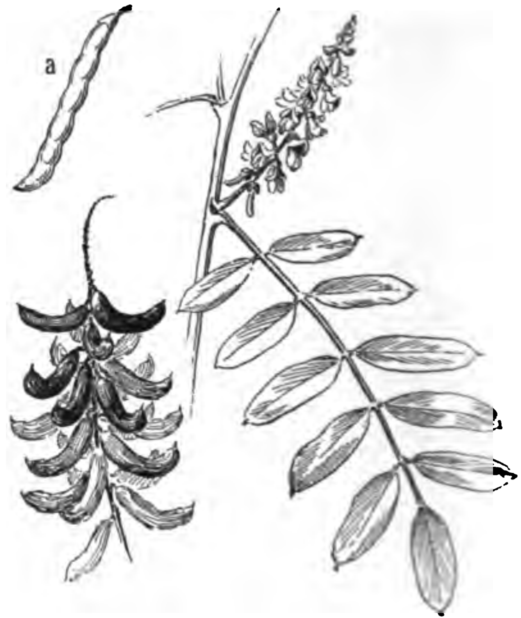
macróstachys, Vent. Shrubby, the stems terete and appressed-pubescent: leaflets 8-10 pairs, oval-oblong. obtuse but mucronate, pubescent: racemes longer than the lvs., many-fld.: fls. rose. China.

Caroliniàna, Walt. Tall and branching: leaflets 5-6 pairs, oblong or obovate: fls. small, many, yellowish brown and with short-acute calyx teeth: legume oblong, 2-seeded, less than ½ in. long. Perennial, in the pine barrens from N. Carolina south.

AA. *Raceme mostly shorter than the leaf.*

austràlis, Willd. (*I. angulàta*, Lindl. *I. sylvática*, Sieb.). A very variable species, known by its glabrous aspect, short or nearly obsolete teeth of the calyx and the pod glabrous when young. Erect shrub: lfts. 9-17, varying from oblong to almost orbicular, ¾ in. or less long, obtuse or retuse: fls. red and mostly showy, the racemes sometimes as long as the lvs.; standard truncate at the base, with a very short claw: pod nearly or quite straight, terete. Austral. B.R. 5:386. L.B.C. 2:149. B.M. 3000.—Extreme South.

tinctòria, Linn. Indigo. Fig. 1133. Shrub, 4-6 ft., with silvery branches: lfts. 7-15, thin, rather large, obovate-oblong, pubescent beneath: fls. small, reddish yellow, in short racemes: pod nearly straight, somewhat knotty, 8-12-seeded. S. Asia.—Long cult. and widely distributed. Runs wild South. Indigo was known to the Egyptians.



1133. Indigofera Anil.
Nearly natural size. The single pod is *I. tinctoria* (× ½)

Ànil, Linn. West Indian Indigo. Fig. 1133. Much like the last, but fls. smaller, and pods curved and not knotty. W. Indies, but now runs wild in the southern states. B.M. 6506.

L. H.B.

ÍNGA (a West Indian name). *Leguminòsæ.* This contains some tropical trees and shrubs, with acacia-like foliage and clusters of showy red stamens. Under this name 3 species are cult. in S. Calif., but 2 of them belong to Calliandra. Another allied genus is Pithecolobium. Inga has pinnate foliage; the other two genera have bipinnate foliage. In Inga the pod is scarcely or slowly dehiscent: in Calliandra the valves dehisce elastically from the apex to the base of the pod and are revolute; in Pithecolobium the valves are often twisted, but never rolled back and elastic.

A. *Leaflets hairy beneath.*

affinis, DC. (consult *I. dúlcis* in the supplementary list). Lvs. simply pinnate; lfts. in 4 pairs, ovate, acuminate, pubescent above, somewhat shining and villous below, one side smaller than the other, 3 in. long, 1¼ in. wide; petioles, branches, peduncles and fls. velvety tomentose, a gland between each pair of lvs.: spikes solitary or in pairs: corollas villous. Trop. Amer.—This is probably the plant cult. in S. Fla. and S. Calif. as *I. dulcis*.

AA. *Leaflets not hairy.*

Feuillei, DC. Lvs. simply pinnate; lfts. in 3–4 pairs, oval-oblong, acute at both ends, glabrous: pods 1–2 ft. long, linear, flat, glabrous, white inside. Peru.—Int. 1900 by Franceschi. The sweet, edible pulp of the pods is much prized by the Peruvians, who call it Pacay.

I. anómala, Kunth. Properly Calliandra grandiflora, Benth. Unarmed: lvs. bipinnate; pinnæ 15–17-paired; lfts. more than 20-paired, linear, obtuse; petioles not glandular: branches, peduncles and fls. puberulous: fls. rosy: pod linear, acute, narrowed at the base, glabrous, thickened at the margin. Trop. Amer.—*I. dúlcis*. The older plant of this name is Willdenow's, which comes from the Philippines, and is described under Pithecolobium. I. dulcis, of Martius, comes from Brazil, and is I. affinis described above. Franceschi's plant of I. dulcis makes a bushy tree, which he says comes from Central America, and has pods containing a white pulp rich in sugar. This plant, he says, grows only in frostless districts, while Inga anomala and pulcherrima will grow where the lemon thrives.—*I. pulchérrima*, Cerv. Properly Calliandra Tweediei, Benth. Lvs. bipinnate; pinnæ 3–5-paired; lfts. as many as 25-paired, paler and slightly hairy beneath: stipules ovato-scariose, brown hairy: peduncle being a head of about 20 fls. Mex. B.M.4188. P.M. 11:147.

W. M.

INKBERRY. *Ilex glabra.*

INSECTICIDES. Substances used to kill insects, as commonly understood; but, as defined in dictionaries, "one who or that which kills, or the act of killing an insect," constitutes an Insecticide. Hence there are many natural Insecticides, such as winds, rains, sudden changes of temperature, forest and prairie fires, insectivorous plants, some bacteria and fungi, several of the higher animals (including man), and many of the invertebrates (including spiders and a host of parasitic and predaceous insects). Oftentimes these Insecticides of nature materially aid man in his warfare against injurious insects, but usually it is necessary to resort to a spray or some other artificial Insecticide.

Insecticides may be classed into those which are eaten with the food and kill by poisoning; powders, washes and gases which kill by suffocation; and certain oils and soaps which kill when they come in contact with the body, and may also suffocate by closing the breathing holes. The poisons are effective against only the biting or chewing insects, and the sucking insects must be hit with a powder, an oil or soap; or both kinds of feeders may be suffocated with the gaseous Insecticides.

Arsenic is the chief ingredient in most poisonous Insecticides. Its solubility in water, causing it to burn the foliage severely, prevents its being used alone. But by boiling one pound of it with two pounds of lime or four pounds of sal-soda in two gallons of water for half an hour, a very cheap, effective and reliable Insecticide results; use about 1¼ quarts to 40 gallons of Bordeaux mixture or water.

Paris green is still the standard poisonous Insecticide, but its cost and adulteration have recently brought several substitutes, such as paragrene and green arsenoid, on the market. London purple is too soluble and variable to give uniform results; hence it is not as much used as formerly. These arsenicals are used at the rate of 1 pound in from 100 to 300 gallons of water or Bordeaux mixture on fruit trees, the most dilute on the peach. Arsenate of lead is now largely used against such insects as the gypsy moth and the elm leaf-beetle; large quantities of it can be used on the foliage without injury, and it adheres better than Paris green, but is sometimes more expensive. Hellebore, the standard currant worm remedy, is especially valuable to use after fruits are more than half grown, when there would be danger from the use of the arsenical poisons.

Tobacco in its various forms is one of the best Insecticides for sucking insects; it is particularly useful in greenhouses. Pyrethrum powder is the standard Insecticide for house-flies, and is often effectively used against other insects.

Kerosene is one of the most active and effective of Insecticides. It can rarely be used with safety undiluted, but as an emulsion with soap, it has been the standard remedy for sucking insects for many years. The formula is: half a pound of soap, 1 gallon hot water, and 2 gallons of kerosene; pour the kerosene into the hot soap solution and agitate violently for a few minutes. Recently, however, manufacturers have devised spray pumps which combine kerosene and water into a good, effective emulsion. These kerowater pumps can be regulated to use certain percentages of kerosene, and they will doubtless largely do away with the making of the kerosene soap emulsion. Whale-oil soap is now extensively and successfully used in killing scale insects and plant-lice. It and the kerowater spray are the most effective sprays now in use against the famous San José scale, the pear psylla, and other sucking insects. Crude petroleum has been successfully used in combatting cattle lice and the horn-fly, and now promises to be an effective and safe substance to apply on dormant trees for the San José and other scales. In California, a resin wash and a lime, salt and sulfur wash are extensively used and found very effective against scale insects; in the East these washes are not so effective.

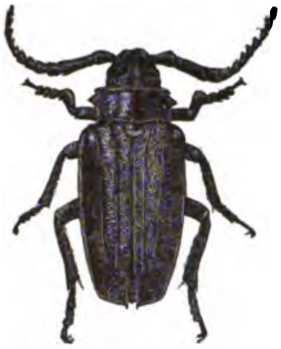
Two gases are extensively used in killing insects. The fumes of carbon bisulfide are certain death to insects infesting stored grains, seeds or clothing. Place the infested material in a tight box; pour the liquid, at the rate of 1 pound to each 100 bushels, or 1 pound to each 1,000 cubic feet, into shallow dishes placed on top of the materials, and quickly close the box, leaving it for a day or so. The fumes are explosive; hence keep all lights away. This liquid has also been successfully used in treating melon and cucumber vines, under covers for plant-lice. The other gaseous Insecticide is hydrocyanic acid gas, the uses of which are discussed below under *Scale Insects*, page 812.

The arsenical poisons seem to be equally effective when applied in combination with the fungicide Bordeaux mixture, and most fruit-growers now spray with such a combination. Sometimes one of the Insecticides for killing sucking insects has been successfully mixed with the Bordeaux, but it is doubtful if they are as effective when thus applied. The poisons do not readily mix with the soaps or oils, and, as a rule, one cannot effectively hit sucking insects, biting insects, or the fungous diseases with a single application of some combination mixture.

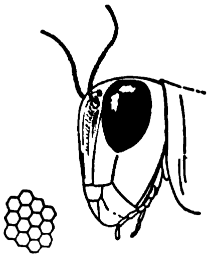
M. V. Slingerland.

INSECTS. The animals which constitute the Insect world play an important part in most horticultural operations. The busy bee is an indispensable aid in the production of many fruits, but the equally busy jaws of canker-worms or other Insects oftentimes seriously interfere with man's plans for profitable crops. Horticulturists should become more intimately acquainted with their little friends and foes in the Insect world. Not only from the economic standpoint is this knowledge necessary in the business of growing plants, but the striking peculiarities of form, coloring, structure, habits, and the wonderful transformations of Insects afford one of the most interesting fields in nature. The life-stories of many Insects, if told in detail, would rival in variety and interest many a famous fairy tale. The science that treats of Insects, or entomology, has now reached the stage where its devotees are no longer looked upon as "crazy bug-hunters" in most communities. A recent directory of the entomologists, or those interested in the study of Insect life, of the United States and Canada contains the names of over 1,200 persons.

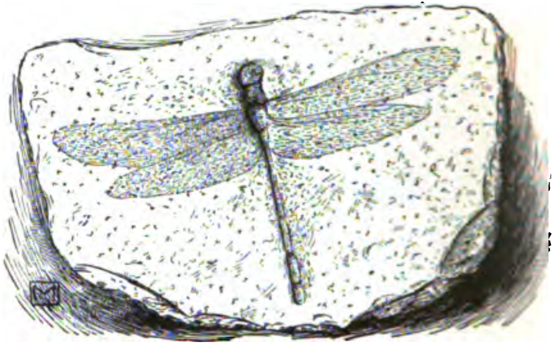
What They Are.—An Insect is an animal which, in the adult stage, has its body divided into three distinct regions: the head, the thorax and the abdomen (Fig. 1134). The head bears one pair of antennæ, and there are always three pairs of legs and usually either one or two pairs of wings attached to the thorax. By these characteristics one can usually readily distinguish an adult Insect from any other animal. Among the near relatives of Insects in the animal world are the cray-fish, sow-bugs and crabs, but these are mostly aquatic animals, breathing by true gills; they have two pairs of antennæ, and at least five pairs of legs. Centipedes, or "hundred-legged worms," and millipedes, or "thousand-legged worms," are also nearly related to Insects, but they have the thorax and abdomen forming a continuous region, with from 6 to 200 segments, each bearing one or two pairs of legs; they have one pair of antennæ. The layman usually classes such animals as the spiders, mites and daddy-long-legs among the Insects, but they form a distinct class, as they have the head and thorax grown together, no antennæ, and have four pairs of legs.

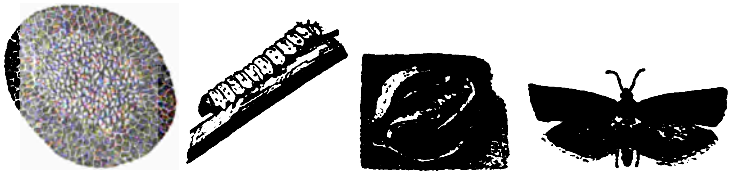

1134. A beetle.
Showing the different parts.

How They Are Constructed.—Insects are constructed on an entirely different plan from the higher animals. Their supporting skeleton is outside, it being simply the skin hardened more or less by a horny substance, known as chitin. This firm outer wall, or skeleton, supports and protects the muscles, blood-vessels, nerves, and other organs within. The mouth-parts, antennæ and eyes of an Insect are attached to its head, and all are exceedingly useful organs, as will be shown later in discussing the feeling and the other sensations of an Insect. An Insect's wings and legs are always borne by the thorax. The wings are primarily organs of flight, but are used as musical organs by some of the grasshoppers and crickets. Female canker-worm moths, bed-bugs, and some other Insects have practically no wings, and the house-flies, mosquitoes, male bark lice, and similar Insects have but one pair of wings. Insects use their legs primarily for walking, running or climbing; some have their front legs modified for catching other Insects for food; others have hind legs fitted for jumping, while the honey-bee has little "pockets" on its hind legs for carrying pollen to feed its young.

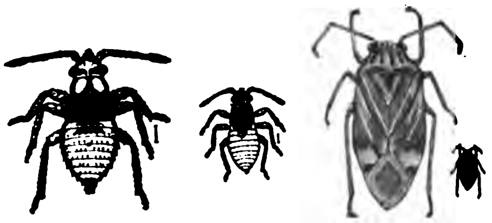

1135.
Head of grasshopper.
Showing the great eye.
A detail of a part of the surface of the compound eye is also shown.

The arrangement of the internal organs in Insects is somewhat peculiar. The alimentary or food-canal in larvæ is a nearly straight tube, occupying the central portion of the body; in adult Insects it is usually much longer than the body and is more or less folded; from the mouth the food passes through a pharynx, an esophagus, sometimes a crop and a gizzard, a stomach, and a small and large intestine. The nervous system of an Insect is similar to that in the higher animals, but it extends along the venter instead of the back. There is a little brain in the upper part of the head, and two nerve cords extend from this around the food canal to another ganglion or nerve center in the lower part of the head; two nerve cords then extend longitudinally along the venter and connect a series of nerve centers or ganglia, typically one for each segment of the body. From each of these ganglia or little brains nerves arise, which supply the adjacent organs and ramify throughout the body. In Insects, all parts of the body cavity that are not occupied by the internal organs are filled with a rich, colorless or slightly greenish blood. There is no system of tubes, like our arteries and veins, in which the blood is confined and through which it flows. There is a so-called "heart" above the food-canal, along the middle line of the back; it is a tube consisting of several chambers communicating with each other and with the body cavity by valvular openings. The blood is forced through this heart into the head, where it escapes into the body cavity. It then flows to all parts of the body, even out into the appendages, in regular streams which have definite directions, but which are not confined in tubes. They, like the ocean currents, are definite streams with liquid shores. Insects do not breathe through the mouth, as many suppose, but through a series of holes along the sides of the body. These openings, or spiracles, lead into a system of air tubes, called tracheæ. These tracheæ branch and finally ramify all through the Insect. Insects have no lungs, but the tracheæ sometimes connect with air-sacs or bladders in the body, which help to buoy up the Insect when flying. Thus the relation between the circulation of the blood and respiration is not nearly so intimate in Insects as in man. In Insects the air is carried to all the tissues of the body in the tracheæ and the blood simply bathes these tissues. Just how the blood is purified and how the waste matter is disposed of in Insects are not yet clearly understood. Aquatic Insects breathe by either carrying down bubbles of air from the surface entangled under their wings, or they may be provided with organs known as tracheal gills; these are usually plate-like expansions of the body that are abundantly supplied with tracheæ, in which the air is brought practically in contact with the air in water, and may thus be purified. More than 4,000 different muscles have been found in a single caterpillar. Notwithstanding their delicate appearance, these muscles are really very strong and their rapidity of action is wonderful; in certain gnats the muscles move or vibrate the wings 15,000 times per second.


1136. Fossil dragon-fly, Petalia longialata (× 1-5).


1137. The four stages in an insect's life—egg, larva, pupa, imago.—The codling-moth.
Egg much enlarged; others × 1⅓.

Their Sensations.—Insects can see, feel, hear, taste and smell, and they may also possess other senses, as a sense of direction. Many Insects have two kinds of eyes. On each side of the head the large compound eye is easily recognized (Fig. 1135); each compound eye is composed of many small eyes, from 50 in some ants to many thousands in a butterfly or dragon-fly. Between these compound eyes, from one to four simple eyes are to be found in many adult Insects. Caterpillars and other larvæ possess only simple eyes. It is thought that each facet of the compound eye sees a part of an object; thus the whole eye would form a mosaic picture on the Insect's brain. The simple eyes doubtless see as our eyes do, and seem to be best adapted for use in dark places and for near vision. Insects do not see the form of objects distinctly, but their eyes are doubtless superior to ours in distinguishing the smallest movements of an object. It is now supposed that no Insects can distinctly see objects at a greater distance than 6 feet. It must be a sixth sense, a sense of direction, which enables the bee to find its way for a mile or more back to its home. Insects are doubtless able to distinguish the color of objects, and some Insects seem to prefer certain colors. Blue is said to be the favorite color of the honey-bee, and violet that of ants; ants are also apparently sensitive to the ultra-violet rays of light, which man cannot perceive. It is generally supposed that the shape and high colors of flowers attract Insects: but recent experiments seem to show that Insects are guided to flowers by the sense of smell rather than by sight.

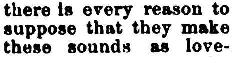

1138. Nymphs of the four-lined leaf-bug and adult of the tarnished plant-bug.
The smallest one is the nymph recently hatched. The next is the nymph after the first moult. The imago is shown at the right. Hair lines at the right of nymphs, and small figure near imago indicate the natural size.

1139. Larva of a sphinx moth.

The hard outer skin of an Insect has no nerves distributed in it, hence it is not sensitive; but it is pierced with holes, in which grow hairs that are in connection with nerves at their base. It is by means of these sensory hairs that Insects feel, and are sensitive to touch on most parts of the body.

1140. Tent-caterpillar.

Doubtless Insects are not deaf, for we know that many of them make sounds, and it must naturally follow that they have ears to hear, for there is every reason to suppose that they make these sounds as love-songs to attract the sexes, as a means of communication, or possibly to express their emotions. Some think that bees and ants hear sounds too shrill for our ears. Insects have no true voice, but produce various noises mechanically, either by rapid movements of their wings, which causes the humming of bees and flies, or by friction between roughened surfaces on the body or its appendages, thus producing the rasping sounds or shrill cries of some crickets and grasshoppers. The house-fly hums on F, thus vibrating its wings 335 times in a second, while the wing tone of the honey-bee is A. Usually the males are the musicians of the Insect world, but it is the female of the familiar mosquito which does the singing, and the "biting" also. The male mosquito doubtless hears the song of his mate by means of his antennæ, as the song causes the antennal hairs to vibrate rapidly. Organs which are structurally ear-like have been found in various parts of the body of Insects. The common brown grasshoppers of the fields have a large ear on each side of the first segment of the abdomen; one can easily distinguish with the naked eye the membrane or tympanum stretched over a cavity. Many of the long-horned green grasshoppers, katydids and crickets have two similar ears on the tibia of each front leg. Some think that mosquitoes have the faculty of the perception of the direction of sound more highly developed than in any other class of animals.

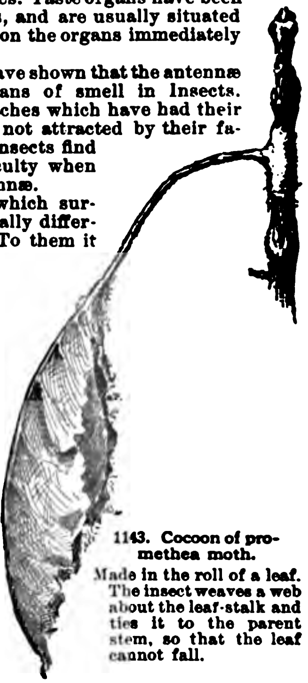

1141. A maggot.
Larva of a dipterous insect.

1142. A grub.
Larva of a beetle.

Insects undoubtedly possess the sense of taste. When morphine or strychnine was mixed with honey, ants perceived the fraud the moment they began to feed. The substitution of alum for sugar was soon detected by wasps. Bees and wasps seem to have a more delicate gustatory sense than flies. Taste organs have been found in many Insects, and are usually situated either in the mouth or on the organs immediately surrounding it.

Many experiments have shown that the antennæ are the principal organs of smell in Insects. Blow-flies and cockroaches which have had their antennæ removed are not attracted by their favorite food, and male Insects find their mates with difficulty when deprived of their antennæ.

The familiar world which surrounds us may be a totally different place to Insects. To them it may be full of music which we cannot hear, of color which we cannot see, of sensations which we cannot perceive. Do Insects think or reason? Why not? Their actions are said to be the result of inherited habit or instinct. But some of them have been seen to do things which require the exercise of instinctive powers so acute and so closely akin to reason that one can hardly escape the conclusion that some Insects are endowed with reasoning powers.


1143. Cocoon of promethea moth.
Made in the roll of a leaf. The insect weaves a web about the leaf-stalk and ties it to the parent stem, so that the leaf cannot fall.

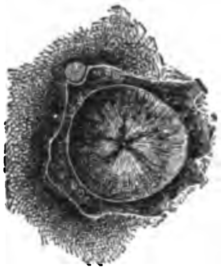
Their Number, Size and Age.—Experts guess that there are from 2,000,000 to 10,000,000 different kinds of Insects in the world. Only about 400,000 of these have yet been described and named by man. Between 30,000 and 40,000 are now known in North America. Four-fifths of all the kinds of animals are Insects; some single families of Insects are said to contain more species than one can see stars in a clear sky at night; and there are as many butterflies as birds in North America. The larger part of the land animals are Insects, and it is asserted that the larger proportion of the animal matter existing on the lands of the globe is probably locked up in the forms of Insects.

Insects vary in size from little beetles, of which it would take 100, placed end to end, to measure an inch, up to tropical species 6 or 8 inches in length, or of equal bulk to a mouse.

Insects have a very long, but, as yet, very imperfect pedigree extending through the geological ages to Silurian times. Fossil remains of many different kinds of Insects have been found in the rocks (Fig. 1136); even such delicate Insects as plant-lice left their impress on the rocks ages ago. In the carboniferous or coal age, the Insect world was evidently quite different from that of to-day, for fossils of veritable Insect mammoths have been found; dragon-flies with a wing-expanse of from 2 to 3 feet then existed. Insect fossils found in the Tertiary rocks indicate that there were more kinds of Insects then than now.

1144. Lengthwise section of the promethea cocoon.

Showing at the apex the valve-like opening through which the moth escaped.



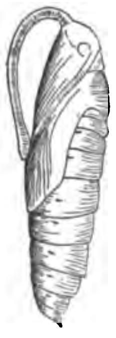
1145. End of cocoon of Cecropia moth.

Inside view, showing where the moth gets out.

Their Growth and Transformations. Fig. 1137.—Insects begin life as an egg; in some cases the egg stage is passed within the body of the mother, which then gives birth to living young. The eggs of Insects exhibit a wonderful variety of forms, sizes, colors and characteristic markings. A single scale Insect may lay thousands of eggs, while some plant-lice produce only one. Remarkable instinct is often shown by the mother Insect in placing her eggs where her young will find proper food.

From their birth the young of some of the lowest or most generalized Insects closely resemble their parents, and they undergo no striking change during their life; hence are said to have no metamorphosis.

In the case of grasshoppers, stink-bugs, dragon-flies, and many other Insects, the young at birth resemble their parents, but have no wings. As they grow, wings gradually develop and often changes in markings occur, until the adult stage is reached. The growth, however, is gradual, and no striking or complete change occurs, and these Insects are said to undergo an incomplete metamorphosis. The young Insects in all stages are called *nymphs* (Fig. 1138); thus Insects with an incomplete metamorphosis pass through three different forms during their life: an *egg*, the young or *nymph* stage, and the *adult*.



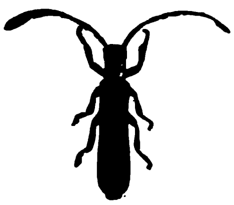
1146. Pupa of tomato worm.

1147. The cabbage butterfly.

From the eggs of butterflies, moths, flies, beetles, bees and some other Insects, there hatches a worm-like creature, much unlike the parent Insect. It is called a *larva* (Fig. 1139); the larvæ of butterflies and moths are often called *caterpillars* (Fig. 1140); *maggots* are the larvæ of flies (Fig. 1141); and the term *grub* is applied to the larvæ of beetles and bees (Fig. 1142). When these larvæ get their full growth, some of them go into the ground, where they form an earthen cell, while others proceed to spin around themselves a silken home or *cocoon* (Figs. 1143, 1144, 1145). In these retreats the larvæ change to a quiescent or lifeless-appearing creature which has little resemblance to either the larva or the parent Insect. It is called a *pupa* (Fig. 1146). The pupæ of butterflies are often called *chrysalids*. Flies change to pupæ in the hardened skin of the maggot. Some pupæ, like those of mosquitoes, are very active. Wonderful changes take place within the skin of the pupa. Nearly all the larval tissues break down and the Insect is practically made over, from a crawling larva to a beautiful, flying adult Insect. When the adult is fully formed, it breaks its pupal shroud and emerges to spend a comparatively brief existence as a winged creature. Such Insects are said to undergo a complete metamorphosis, and pass through four strikingly different stages during their life: the egg, the worm-like larva, the quiescent pupa, and the adult Insect. Such remarkable changes or transformations make the story of an Insect's life one of intense interest to one who reads it from nature's book. Various kinds of adult Insects, or imagoes, are shown in Figs. 1147–1152.

1148. Imago of a tent-caterpillar.

No two kinds of Insects have the same life-story to tell. Some pass their whole life on a single host; some partake of only a certain kind of food, while others thrive on many kinds of plants; some are cannibals at times, and others, like the parasites, are boarders within their host, while many prey openly on their brethren in the Insect world. Usually the life of the adult Insect is brief, but ants have been kept for thirteen years, and the periodical cicada has to spend seventeen years as a nymph underground before it is fitted to become a denizen of the air. The winter months may be passed in any of the different stages of the Insect's life. Two very closely allied Insects may have very different life habits.



1149. A beetle.
The adult of a borer larva.

How They Grow.—Many people believe that the small house-flies grow to be the large ones. While most Insects feed after they become adults, they get little or none of their growth during their adult life. Insects grow mostly while they are larvæ, or nymphs. The maggots from which the little house-flies develop doubtless do not have as luxuriant or favorable feeding grounds as do those of the larger flies. In 30 days some leaf-feeding caterpillars will increase in size 10,000 times; and a certain flesh-feeding maggot will in 24 hours consume two hundred times its own weight, which would be paralleled in the human race if a one-day-old baby ate 1,500 pounds the first day of its existence! The skin of Insects is so hard and inelastic that it cannot stretch to accommodate such rapid growth. But nature obviates this difficulty by teaching these creatures how to grow a new suit of clothes or a new skin underneath the old one, and then to shed or moult the lat-

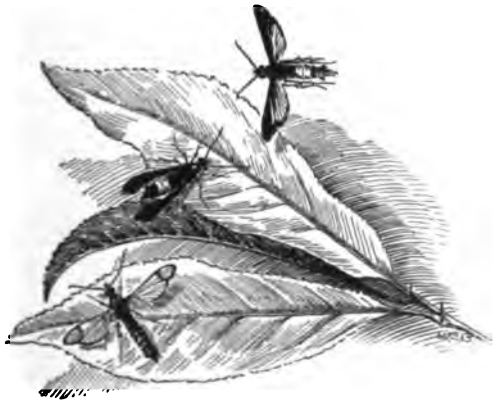
1150. One of the weevil beetles
With a long and strong proboscis.

ter. The old skin is shed in its entirety, even from all the appendages, and sometimes remains in such a natural position where the Insect left it as to easily deceive one into thinking that he is looking at the Insect rather than at its cast-off clothes. Some Insects are so neat and economical that they devour their old suits or skins soon after moulting them. Larvæ, or nymphs, may moult from two or three to ten or more times; the larvæ do not often change strikingly in appearance, but the nymphs gradually acquire the characters and structures of the adult.

1151. Ground beetle.
One of the commonest predaceous insects.

***How They Eat.*—To the horticulturist, the mouth-parts of an Insect are its most important organs or appendages. The mouth-parts are built on two very different plans. Grasshoppers, beetles, caterpillars and grubs have two pairs of horny jaws, working from side to side, with which they bite or chew off pieces of their food, that then pass into the food-canal for digestion (Fig. 1153). The scale Insects (Fig. 1154), plant-lice, true bugs (Fig. 1155), mosquitoes and others have these jaws drawn out into thread-like organs, which are worked along a groove in a stiff beak or extended under lip. Such Insects can eat only liquid food, which they suck with their beak-like mouth-parts. The Insect places its beak on the surface of the plant, forces the thread-like jaws into the tissues, and then begins a sucking operation, which draws the juices of the plant up along the jaws and the groove in the beak into the food-canal of the Insect.**

Thus a sucking Insect could not partake of particles of poison sprayed on the surface of a plant. Its mouth-parts are not built for such feeding, and as it is impracticable to poison the juice of the plant, one is forced to fight such Insects with a deadly gas, or each individual Insect must be actually *hit* with some insecticide. A knowledge of these fundamental facts about the eating habits of Insects would have saved much time and money that have been wasted in trying to check the ravages of sucking Insects with Paris green and similar poisons.

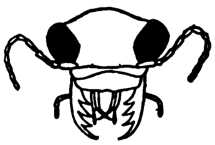


1152. Moths of the peach-tree borer.
The lowest one is male.

Some Insects, like the bees and wasps, have mouth-parts fitted both for sucking or lapping and for biting.

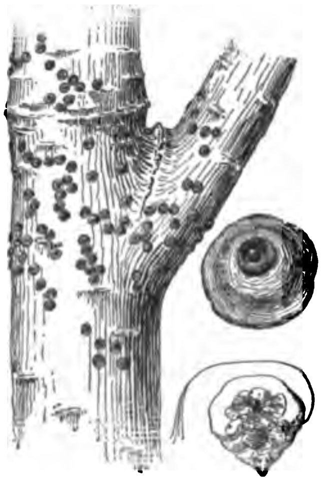
Beneficial Insects.—The horticulturist has many staunch and true friends among the Insects. The honey-bee, the many wild bees, and other Insects, as they visit the blossoms to get food for themselves, for their young, and honey for man, leave an insurance policy in the shape of tiny grains of pollen, which often insures a crop of fruit that otherwise might be extremely uncertain. The honey-bee is often accused of biting into ripe fruits, especially grapes. They have not yet been proved guilty, and careful, exhaustive experiments have shown that they will not do it under the most favorable circumstances. Wasps and other strong-jawed Insects are responsible for most of this injury, the bees simply sipping the juice from the wound.

Most of the pretty little beetles known to every child as "lady-bugs" eat nothing but injurious Insects; many other beetles are also predaceous. Man is also often deeply indebted to many of the two-winged Insects or true flies whose larvæ live as parasites inside the body of Insect pests or feed upon them predaceously. Were it not for the ravenous larvæ of the "lady-bugs" and of the syrphus flies, plant-lice of all kinds would soon get beyond control. While man must recognize these little friends as valuable aids in his warfare against the hordes of Insect pests, it will rarely be safe to wait for the pests to be controlled by their enemies. Fig. 1156 shows a tomato worm bearing the cocoons of a parasite. Fig. 1151 shows one of the predaceous beetles destroying a cutworm.



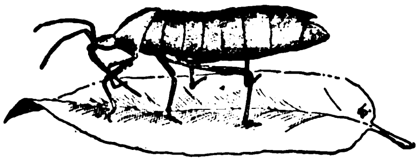
1153. Mouth-parts of a biting insect.

Injurious Insects.—There are now about a thousand different kinds of Insects that may be classed as injurious in the United States and Canada. Over 600 kinds were exhibited at the Columbian Exposition in 1893. All of these may not be injurious every year, as most Insect pests have periods of subsidence, when certain factors, possibly their enemies or perhaps climate conditions, hold them in check. The outlook for American horticulturists, so far as injurious Insects are concerned, is not encouraging. Nowhere else in the world are Insects being fought as intelligently, successfully and scientifically as in America, yet we never have exterminated, and it is very doubtful if we ever will, a single Insect pest. This means that American horticulturists will never have any fewer kinds of Insects to fight. On the contrary, there are many more Insect pests now than in our grandfather's early days, and new pests are appearing every year. This alarming state of affairs is largely due to two causes, for both of which man is responsible. Man is continually encroaching upon and thereby disturbing nature's primitive domain and the equilibrium which has there become established between animals and plants. In consequence, Insects like the Colorado potato beetle, the apple-tree or the peach-tree borers have been attracted from their original wild food-plants to man's cultivated crops, which often offer practically unlimited feeding grounds. Most of the new Insect pests, however, are now coming to America from foreign shores. American horticul-



1154. San José Scale.
Showing the mature winter scale; also the insect itself, with its thread-like feeding organs.

turists are continually importing plants from the ends of the earth, and oftentimes the plants are accompanied by one or more of their Insect pests. Some comparatively recent introductions of this kind are the sinuate pear-borer, the pear midge, the gypsy moth, the brown-tail moth, the horn-fly and the elm leaf-beetle; such standard pests as the Hessian fly, the cabbage butterfly, the currant-worm, the codling-moth (Fig. 1137) came in many years ago. Of the 73 Insects which rank as first-class pests, each of them almost annually causing a loss of hundreds of thousands of dollars, over one half have been introduced from foreign countries, mostly from Europe. It is a significant fact that usually these imported Insects become much more serious pests here than in their native home; this is doubtless largely due to the absence of their native enemies, to more favorable climatic conditions here, and to a less intense system of agriculture in this country. Most of our worst Insect pests of the fruits, of the garden crops, of the granary, of the household, of the greenhouse, and practically all of our most dangerous scale Insects, are of foreign origin. Man will continue to encroach on and disturb nature's primitive domain, and commercial operations will never cease, nor is there much hope of ever effectually quarantining our shores against these little foes; hence there seems to be no practicable way to stop this increase of the Insect enemies of the horticulturist. The one who is the best fitted by nature, and who best fits himself with a knowledge of these pests and how to fight them, will usually be the one to survive and reap the reward of profitable crops. No part of a plant, from its roots to the fruit it produces, escapes the tiny jaws or the sucking beaks of Insects.

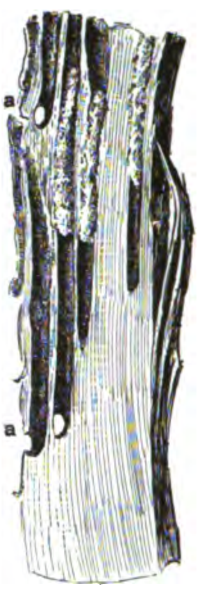

1155. Hemipterous insect.
Known to entomologists as a true bug.

Root-feeding Insects.—Many of the small fruits and vegetables are often seriously injured by Insects feeding on the roots. The grape-vine fidia (the grub of a small beetle) and the grape phylloxera plant-louse live on grape roots. Strawberries often succumb to the attacks of the grubs of several small beetles known as strawberry-root worms, and to the large white grubs of the May beetles. The roots of cabbages, radishes and other cruciferous plants are often devoured by hordes of hungry maggots.

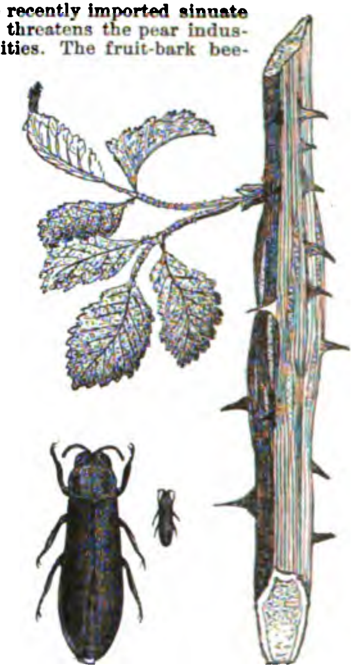
1156. Tomato worm attacked by parasitic insects.

These underground root-feeding Insects are difficult pests to control, like any other unseen foe. Sometimes they can be successfully reached by injecting a little carbon bisulfide into the soil around the base of the plant. The cabbage maggots can be largely prevented by the use of tarred paper pads placed around the plants, or by pouring a carbolic acid emulsion at the base of the infested plants. The strawberry root-feeders are best controlled by frequent cultivation and a short rotation of crops.

Borers.—These are the larvæ of several different kinds of Insects, which burrow into and feed upon the inner bark, the solid wood, or the interior pith of the larger roots, trunks, branches, and stems or stalks of many horticultural plants. Nearly every kind of fruit trees is attacked by its special kind of borer, as are also many of the smaller vine and bush-fruits and garden crops. Borers are often the most destructive of Insect pests. The two apple-tree borers, the round-headed (Fig. 1157) and the flat-headed species, and the peach-tree borer (Fig. 1152) doubtless cause the death of as many apple and peach trees in America as all other enemies combined. The recently imported sinuate pear-borer seriously threatens the pear industry in infested localities. The fruit-bark beetles, or "shot-hole" borers, usually attack only unthrifty or sickly fruit trees, and a tree once infested by them is usually doomed. Two borers, one the grub of a beetle and the other the caterpillar of a moth, sometimes tunnel down the stems of currants and gooseberries. Raspberries and blackberries (Fig. 1158) also suffer from two or three kinds of borers, one working in the root, one in the stem, and a maggot bores down and kills the new shoots. A caterpillar closely allied to the peach-tree borer lives in squash vines, often ruining the crop. The potato-stalk weevil sometimes does much damage in potato fields.

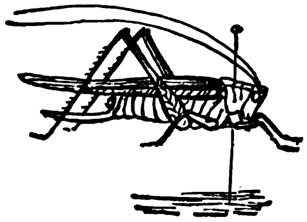


1157. Burrows of an apple-tree borer.
The holes at *a* show where the imago or beetle emerged.


1158. A beetle borer and its work.
The larva bores in the young wood of raspberry and blackberry canes, causing the swellings seen in the picture.

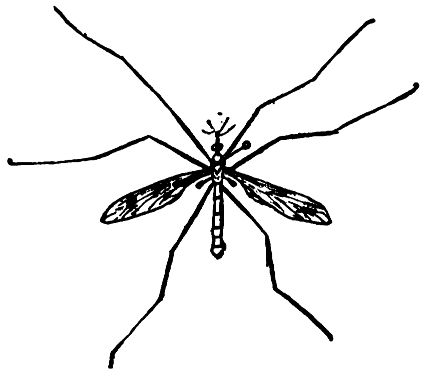
Sometimes one can prevent borers from getting into a fruit tree with a paper bandage closely wrapped around the part liable to be attacked, or by the application of some "wash." Most of the washes recommended will prove ineffectual or dangerous to use. Gas tar has given good results, but some report injury to peach trees from its use; hence one should first experiment with it on a few trees. No way has been found to keep borers out of the small fruits or garden crops; usually if infested canes, stems or plants are cut out and burned early in the fall or whenever noticed, most of the borers will be killed. When borers once get into fruit trees, the "digging-out" process is usually the only resort, although some report that they readily kill the depredator by simply injecting a little carbon bisulfide into the entrance of his burrow and quickly closing it with putty.

Bud and Leaf-feeding Insects.—The buds and leaves of horticultural crops often swarm with legions of biting and sucking Insects. A mere enumeration of the different kinds of these pests would weary the reader. Some Insects, like the rose chafer, work on several different kinds of plants, while many others attack only one or two kinds. In apple orchards, the opening buds are seized upon by the hungry bud-moth and case-bearing caterpillars, by the newly-hatched canker-worms, and by tent-caterpillars, whose tents or "signboards" are familiar objects in many orchards. These pests continue their destructive work on the leaves. The pear slug often needs to be checked in its work of skeletonizing the leaves of the pear and cherry. The pear psylla, one of the jumping plant-lice, is a very serious menace to pear-growing in many localities; the fruit is either dwarfed or drops from badly infested trees, and sometimes so many little pumps sucking out its life finally cause the death of the tree. The little blue grape-vine flea-beetle often literally nips the prospective crop of fruit in the bud, or the rose-chafer may swarm over the vines and eat the foliage or blossoms. Currant and gooseberry growers realize that eternal vigilance against the familiar green currant worms is the price of a crop of fruit. The asparagus beetles would soon appropriate every asparagus shoot that appears in many localities. It is a continual struggle against Insect pests to get a paying crop of almost any vegetable. The several kinds of cabbage caterpillars would soon riddle the leaves. The hungry striped cucumber beetles can hardly wait for the melon, squash, or cucumber vines to come up. Two sucking Insects, the harlequin cabbage bug and the squash stink-bug, are equally as destructive as their biting relatives.


1159. Grasshopper. Mounted.

The bud- and leaf-feeding Insects are usually readily controlled by spraying some poison on their food, or by hitting them with some oil or soap spray. As the female moths of canker-worms are wingless, a wire trap or sticky bandage placed around the trunk of the tree in the late fall and early spring, to capture the moths as they crawl up the tree to lay their eggs, will greatly help to check these serious pests. The collection and burning of the conspicuous egg-rings of the tent-caterpillars at any time between August and the following April, will greatly reduce the vast numbers of tents or signboards of shiftlessness in apple orchards. Hand-picking or collecting is the most successful method of controlling the rose-chafer, harlequin cabbage bug, and the squash stink-bug in many cases. Prompt action, guided by a knowledge of the Insect's habits and life-history, and an intelligent use of materials and apparatus, are essentials in any successful effort to control these bud- and leaf-feeding pests of the horticulturist.

Fruit-eating Insects.—"Wormy" apples, pears, quinces, plums, peaches, cherries, apricots, grapes, currants and nuts are often the rule rather than the exception. The codling-moth or apple-worm often ruins from one-third to one-half of the crop each year in many localities; it also infests pears seriously. The apple maggot tunnels its way through and through the flesh of a large percentage of the apples in the northern sections of the country. Most of the wormy plums, peaches, cherries and apricots are the work of the grub of that worst Insect enemy of the stone fruits—the plum curculio; the plum gouger, a similar Insect, whose grub works in the pit of plums, is equally destructive to this fruit in some states. "Knotty" quinces are largely the work of the adults of the quince curculio, while its grub often ruins the fruit with its disgusting worm-hole. There is also a grape curculio, that, with the aid of the caterpillar of a little moth, works havoc in grapes. Currants and gooseberries are often wormy from the work of two or three different kinds of maggots and caterpillars. A new pest has now included the delicious cherry in its menu; it is a fruit-fly, closely allied to the apple maggot; infested cherries may show no external signs of the presence of the maggot reveling in the juices within. Various small beetles, known as weevils, are responsible for most wormy nuts.


1160. A crane fly. Mounted.

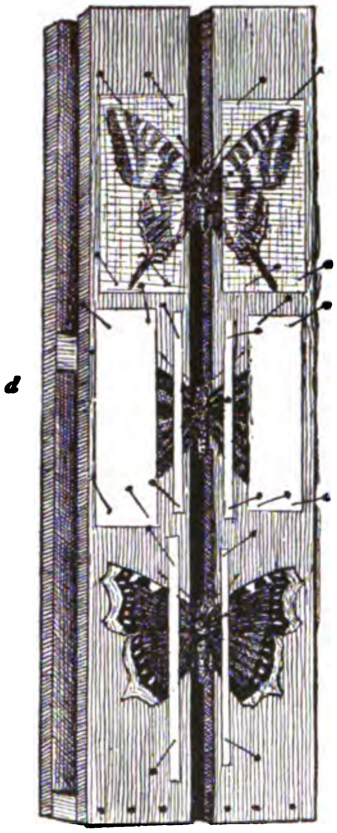
Most of the fruit-eating Insects are out of the reach of the ordinary insecticides. The codling-moth is a noted exception, however, for the peculiar habit that the little caterpillar has of usually entering the blossom end of the fruit and feeding therein for a few days, gives the man with a poison spray a very vulnerable point of attack. It is only necessary to spray a bit of poison into the open calyx cup within a few days after the petals fall, and let nature soon close the calices and keep the poison therein until the newly-hatched caterpillar includes it in its first menu. Often 75 per cent of the apples that would otherwise be ruined by the worms are saved by an application of Paris green at this critical time. The fact that the apple maggot never leaves the fruit until after it is picked or has fallen from the tree, gives one a chance materially to reduce its numbers by frequently gathering the windfalls and feeding them to stock or burying them deeply. As the plum curculio, in the adult stage, feeds on the leaves and fruits, a poison spray, applied soon after blossoming time, is apparently sometimes effective against it, particularly on cherries. Many extensive growers of the stone-fruits, however, are satisfied that this pest can be best circumvented by jarring the curculios onto sheets and killing them; the quince curculio is also best fought by the jarring method. Hand-picking of the infested fruits must be practiced when grapes, currants or gooseberries are attacked by fruit-eating Insects.

1161. A snapping beetle. Mounted.

Plant-Lice.—Scarcely a plant escapes the little suction pump or beak of some kind of a plant-louse or aphis. About 250 different kinds of plant-lice have been identified in the United States, and nearly every kind of fruit, flower, farm or garden crop has its special plant-louse enemy, which is often a serious factor in the production of a crop. These little creatures are so small, so variable, so hard to perceive, present so many different forms in the same species, and have such varied and interesting life-stories to tell, that what we now know about them is but a mere beginning as compared to what is yet to be learned. It would take a large volume to include the interesting stories which might be told of the lives and of the relations with ants of some of the commonest of these plant-lice. No other group of Insects presents so many curious, varied, interesting, and wonderful problems of life as do the aphids.

In the aggregate, the damage done by plant-lice is very great. At times hundreds of acres of peas have been ruined by an aphid. Nursery stock often suffers severely, but bearing fruit trees are not often seriously injured by them. About 40 different kinds of aphides live in greenhouses, where a perpetual warfare has to be waged against them. In 4 years we have reared nearly 100 generations of a common aphis in greenhouses, and there were no indications of any egg-stage or of male forms during this time, so that they may thus breed indefinitely in houses, their young being born alive and no males appearing.

The standard remedies for plant-lice are whale-oil soap, kerosene emulsion, kerowater, and tobacco in various ways (as a decoction, dry as a dust, or the "Roseleaf" or similar extracts), and these are successfully used to kill the aphides in all situations.



1162. A spreading board for drying soft-winged insects.

Scale Insects.—Since the recent advent of the San José scale into the eastern United States, scale Insects of all kinds have attracted world-wide attention. They are all small Insects, and derive their name from the fact that their tender bodies are protected by hard, scale-like coverings secreted by the Insects. Thus protected, they are difficult Insects to kill, and as they are easily transported on nursery stock, buds or cions, and also multiply rapidly, the scale Insects are justly to be considered as among the most dangerous and destructive of injurious Insects. A single female San José scale may rear a brood of from 100 to 600 young, and there may be four or five generations a year; and more than 2,000 eggs have been laid by a single Lecanium scale.

The scale Insects, the dreaded San José species included, can be successfully controlled by judicious, intelligent and timely work with sprays of whale-oil soap, kerowater, crude petroleum, or hydrocyanic acid gas, which should be used in the case of nursery stock.

Since 1889 fumigation with hydrocyanic acid gas has been extensively practiced in the citrous orchards of California, and now Florida and South African fruit-growers are also using it in their orchards. Large gas-tight tents or boxes are placed over the trees and the gas then generated within. Much nursery stock is now treated with the gas in tight boxes or houses; this is required by law in Maryland and the province of Ontario, and it should be practiced in other regions. Recently greenhouses, railway coaches, rooms in private houses, and whole flouring mills have been effectively fumigated with this gas. It is generated with water, a good grade of commercial sulfuric acid, and potassium cyanide 98 to 99 per cent pure. The acid is poured into the water in an earthen jar or crock and the cyanide then dropped in. In fumigating trees, rooms or flouring mills, 1 ounce of the cyanide, 1½ fluidounces of sulfuric acid, and 2¼ ounces of water are used for every 125 cubic feet of space; for nursery stock use the same amounts for each 100 cubic feet of space; in greenhouses the gas is used about one-half as strong, or even less for some kinds of plants. Nursery stock, trees and plants in greenhouses are usually subjected to the gas for from 30 to 60 minutes; mills are usually kept closed 12 to 24 hours. As potassium cyanide and hydrocyanic acid gas are among the most deadly poisons, fumigation should be under the direct supervision of competent persons.

Insects are preserved in collections by securing them in tight cases by means of a pin inserted through the thorax, or through the right wing if the subject is a beetle. Moths and butterflies are pinned in position on a spreading-board until thoroughly dried. See Figs. 1159–1163. Every horticulturist should make a collection of injurious Insects.

Insect Literature for Horticulturists.—Horticulturists should keep in close touch with the experiment stations and state entomologists of their own and of other states, and also with the Department of Agriculture at Washington; for it is from these sources that the best and latest advice regarding injurious Insects is now being disseminated free, either by personal correspondence or by means of bulletins. Among the books, one or more of which may well find a place in a horticulturist's library are the following: Weed's "Insects and Insecticides," Sempers' "Injurious Insects and the Use of Insecticides," Lodeman's "The Spraying of Plants," Saunders' "Fruit Insects," and Smith's "Economic Entomology."

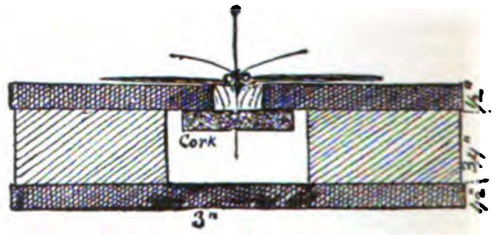
M. V. SLINGERLAND.

INULA (ancient name). *Compósitæ.* This genus includes some hardy herbaceous plants of the easiest culture and of rather coarse habit, with heads of yellow or orange, each 2–4 in. across, borne in summer. There is such a great abundance of autumn-flowering yellow composites in the hardy border that only those Inulas that bloom in early summer are particularly desirable. Elecampane, *I. Helenium*, is probably also cultivated for medicine. A preparation of the mucilaginous roots is common in drug stores. Inula flowers have as many as 40 linear rays. The plants like a sunny position in any garden soil, and are prop. by division or seed.

Inula is a genus of about 56 species, found in Europe, Asia and Africa: herbs, usually perennial, glandular, hairy: lvs. radical or alternate, entire or serrate: heads large, medium or small, solitary, corymbose, panicled or crowded at the crown: rays yellow, rarely white.

A. *Stems panicled or corymbose.*

Helènium, Linn. ELECAMPANE. Fig. 1164. Tall, thick-stemmed: lvs. unequally dentate-serrate: root-lvs. elliptic-oblong, narrowed into a petiole; stem-lvs. half-clasping, cordate-oblong: outer involucral parts leafy, ovate. Wet, sandy and mountainous regions. Eu., N. Asia. Naturalized in Amer. D. 163.—For medicinal purposes, 2-year-old roots should be dug in August. If older they are likely to be stringy and woody.



1163. A cross-section of spreading board in front of the cleat "d," in Fig. 1162.

AA. *Stems 1-fld., or with at most 2 or 3 heads.*

B. *Outer involucral parts linear and numerous.*

grandiflòra, Willd. Height 2–3 ft.: lvs. elliptic-oblong, serrulate, all sessile; upper ones subcordate; lower ones 2–4 in. long: glands numerous: heads 3¼–4 in. across. Himalayas, Caucasus. G.F. 6:406.—Cult. but not advertised. Earliest blooming Inula in cult. Bears orange-yellow fls. 5 in. across in June, and has bold but not coarse habit.

glandulòsa, Willd. Height 2–3 ft.: lower lvs. oblong-spatulate, long-attenuate at the base, the uppermost oblong with a subcordate-decurrent base, all entire or very obsoletely denticulate: glands remote. Caucasus. B. R. 4:334. B. M. 1907. Gn. 22, p. 234; 25, p. 101; 49:1047 and p. 7. J.H. III. 35:153. R.H. 1881, p. 419. G.M. 33:541 and 38:477.—Keller says it has deep golden yellow, fringed, half-drooping rays. Rays are commonly said to be entire, but B.M. 1907 shows 2 minute teeth, and in B.R. 4:334 the fringes are more than a quarter of an inch long. This is said to be the only cult. species that does not seed freely. The Garden pictures an orange variety.

1164. Elecampane, Inula Helenium.

Hoòkeri, C. B. Clarke. Height 1–2 ft.: lvs. 3–4 in. long, sessile or narrowed into very short petioles, oblong-lanceolote, acute at the base, minutely toothed, glandular: heads 2½–3½ in. across; rays "pale yellow," according to Hooker. Himalayas. B.M. 6411 (rays pure yellow).—Fls. orange-yellow, according to J. W. Manning. J. B. Keller says it flowers in Aug. and Sept., and has bright yellow fringed rays. However, in B.M. 6411 the rays have only 3 minute teeth.

BB. *Outer involucral parts lanceolate and leafy.*

hírta, Linn. Lvs. netted-veined, lanceolate or ovate-oblong, the lowest narrowed at the base, the others rounded at the base and half-clasping. Eu., N. Asia. —Keller says it grows 15–18 in. high and fls. July–Aug.

ensifòlia, Linn. Lvs. with numerous somewhat parallel nerves, narrowly linear-lanceolate, involucral parts appressed, not spreading. Eu., N. Asia. G.M. 41:559.—Keller says it grows 6–8 in. high and fls. July–Aug. Rockery plant; blooms first year from seed if sown early.

W. M.

IOCHRÒMA (Greek, *violet-colored*). *Solanàceæ.* This genus includes 2 handsome flowering shrubs cult. outdoors in S. Calif. and under glass in Europe. They are tall-growing, and bear clusters of as many as 20 tubular, drooping fls., each 1–1½ in. long and less than ½ in. across at the mouth, which seems to have 10 short lobes, but 5 of these are shorter, and are really appendages in the sinuses between the 5 typical lobes. Iochroma is a genus of about 18 American species, mostly tropical and South American: trees or shrubs: lvs. entire, usually large: fls. violet, blue, white, yellowish or scarlet: berries globose or ovoid, pulpy.

A. *Fls. indigo-blue.*

lanceolàta, Miers. Shrub, 4–5 ft. high (taller in Calif.), the young branches herbaceous and downy, with stellate hairs: lvs. alternate, oval or elliptic-lanceolate, acute, entire, tapering below into a long petiole: umbels supra-axillary and terminal. Equador. B.M. 4338 and F.S. 4:309 (as *Chænesthes lanceolata*).

AA. *Fls. scarlet or orange-scarlet.*

fuchsioides, Miers. Lvs. often clustered, obovate, very obtuse, tapering at the base into a short petiole. Peru. B.M. 4149 (as *Lycium fuchsioides*).

IONIDIUM. For *I. concolor*, see *Solea.*

IONOPSÌDIUM (Greek, *violet-like*). *Cruciferæ. I. acaule* is a pretty, tufted little plant, growing 2 or 3 inches high and bearing numerous small 4-petaled, lilac fls. from spring to fall. It is a half-hardy perennial from Spain and N. Africa, but is treated as an annual. It is desirable for edgings in moist, shady places, and for rockeries. In rich garden soil the plants make numerous runners. The fls. are about ½ in. across, 1 on each stalk. They open white and turn lilac. The plant has been advertised as the Diamond Flower by seedsmen. This plant is referred by Index Kewensis to Cochlearia, a genus whose limits are very uncertain.

acaùle, Reichb. (*Cochleària acaùlis*, Desf.). Lvs. ovate-rotund, heart-shaped at the base; petioles proportionately very long: pods subrotund, notched. B.R. 32:51.

W. M.

IONÓPSIS (Greek, *violet-like*). *Orchidàceæ.* A small genus of epiphytic orchids, numbering about 10 species, many of which can probably be reduced to varieties of a few species. Most of the species are insignificant, only one or two being cultivated. The fine specimen of *I. paniculata* figured in the Botanical Magazine has a panicle 10 in. long, 8½ in. wide, with 5 branches, and about 80 fls., each three-quarters of an inch across and chiefly white, with violet markings near the center and a dash of yellow. In its native country it is said to remain in attractive condition from Sept. to May. The fls. are produced so freely and over so long a period that it is sometimes necessary to destroy the flower spikes, which are out of all proportion to the number of lvs. The plants succeed in the warmhouse under the same treatment as Burlingtonias or the more delicate Oncidiums.

Ionopsis consists of tropical herbs without pseudobulbs, having very short stems, with few, narrow, sheathing, coriaceous lvs.: sepals subequal, erect, spreading, the dorsal one free, the lateral ones united into a short spur behind; petals like the dorsal sepals; labellum united to the base of the column, middle lobe large, expanded, 2–3 times as long as the sepals, 2-lobed; column short: pollinia 2: fls. small, in simple racemes or much-branched panicles.

paniculàta, Lindl. Lvs. thick and channelled, linear lanceolate, keeled, 2–3 in a cluster and about 6 in. long: panicle much branched and spreading, loaded with innumerable fls. of a delicate texture: sepals and petals very short, sharp-pointed, the petals wider; labellum very large, pubescent at base, with a 2-lobed rounded limb, which in some is almost entirely white, while in others it has a spot of purple or yellow on the disk. Winter. Brazil. B.M. 5541. F.S. 22:2333 A.F. 6:631.—Very variable.

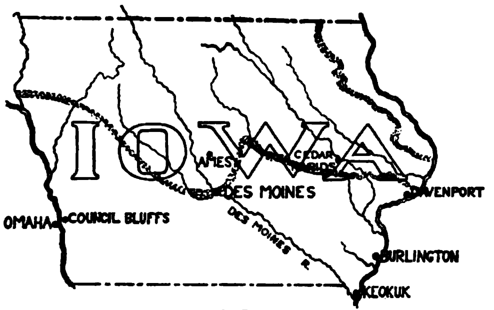
utricularioides, Lindl. Lvs. and general habit as in the last: sepals and petals bluntish; spur short; labellum almost twice as long as the petals; lobes subquadrate-rounded, white, streaked with red veins. Jamaica.

H. HASSELBRING.

The best means of culture for the successful growing of these beautiful though delicate orchids is in shallow pans, with plenty of small broken coal cinders for drainage, covered with the fine particles of fern root and chopped sphagnum gathered from the upland meadows. Plenty of heat and moisture during the growing season are essential. Rest them in winter at a temperature of 50° to 55° F. William Mathews.

IOWA, HORTICULTURE IN. Fig. 1165. Iowa is nearly a rectangle, about 200 miles north and south between the parallels 40° 36′ and 43° 30′, and 300 miles east and west, bordered on the east by the Mississippi and on the west by the Missouri and the Big Sioux rivers. Its extreme elevations are 444 feet in the southeast corner, and 1,694 at the highest point near the northwest corner, the average elevation being about 800 feet above the sea. The surface is a gentle, undulating, grassy plain, well drained by numerous streams discharging into the rivers on its borders. All these streams are bordered more or less broadly with belts of native timber, often many miles in width along the larger ones. The divide between the streams falling eastwardly and those falling westwardly is a line running from a little east of the northwest corner southwardly to about the middle of the state at the Missouri line, draining three-fourths of the state into the Mississippi and one-fourth westwardly. The entire surface, except a short and narrow belt along the Mississippi at the northeast corner, is found deeply covered with glacial drift, the depth varying from a few feet to 200 feet or more. In about half the state this drift is overlaid more or less deeply with the peculiar deposit called loess, this being mainly in the south, extending farther north on the west, as shown by the map.

There are no regions the size of Iowa which contain fewer acres unfit for agriculture. Agriculture is as profitable in northern Iowa as in the southern part. Horticulture, however, has had a greater development in the southern and southwestern counties, the region of the fruit-bearing loess. It is not attempted to draw a hard and fast line below which fruit-growing is easy and above which it is difficult, but only to indicate, in a general way, that in the north and increasing with the distance, greater care must be used in selecting situations and varieties in culture and in protection.



1165. Iowa.
To show horticultural regions.

If safe conclusions may be drawn from the native fruits and nuts found in Iowa, the state has great horticultural adaptabilities. The native nuts, the walnuts, black and white, the hickories and hazelnuts, are abundant and of high quality, and the pecan is found along the Mississippi. The fruits, especially the currants, raspberries, apples and plums, will compare favorably with the natives found in Europe, and the plums greatly excel. It cannot be doubted that they will soon be developed into varieties fit to satisfy the most exacting tastes. Many hybrids have been secured between the native and the cultivated apples descended from Europe, and this line of work, hitherto neglected, is believed to promise a race of apples entirely adapted to the inter-continental climatic conditions of the region

The apples of Europe, and their descendants, originating along the eastern seaboard, have not been found entirely successful over the region of broader prairies, but have succeeded best in the southern half of the state, and especially on or near the timbered lands. Here, commercial orcharding has had its greatest development. This industry is so young that statistics have not been systematically gathered, but in the most favored localities apple crops to the value of $100 a year per acre are not uncommon. Fruit, to the value of more than $350,000, has been reported as the product of a single county in one year, this being mainly of winter apples, the surplus finding markets in the Northwest, in the East, and in foreign countries.

In isolated localities, commercial apple-growing has been fully as successful in the north, but has necessarily been confined to a few sorts, chiefly two, the Oldenburg and the Wealthy. It has always been found that the long-keeping sorts of highest quality have been fastidious in choice of location in the south, and still more so northward, where early maturing sorts are more successful.

Pear-growing is everywhere difficult. Much time and money have been spent with eastern and foreign varieties without satisfaction. This fruit is profitably grown in a few localities only, and under management of exceptional skill. A race of prairie-born seedlings must, apparently, be grown to insure success.

With plums, the reverse is true. A generation of men tried to acclimatize the plums of Europe, and lately the effort has been extended to the Japanese, but without satisfaction; in fact, no others succeed in competition with the natives of the soil. These, and especially the Americana types, are so well adapted, so profusely productive of such handsome and good fruit, that even as they came from the hand of nature, they have taken substantial possession of the nurseries and orchards of the state. Such flattering successes have followed the first attempts to grow them for market, that the industry is fast assuming large proportions. New and improved varieties of larger size and finer quality are offered every year, and a bright future for that fruit is assured.

Of cherries, only the sour sorts succeed, and little effort has been made to breed sweet varieties better adapted to prairie conditions. Commercial cherry-growing is successful in the southern half of the state, and is rapidly increasing.

Peaches have been grown in limited quantities in the southeast since the first settlement of the state. By seedling selection, the limit of success is gradually extending northward and now reaches to the middle of the state, but only for home use, as yet.

The quince and the apricot cannot be said to succeed in Iowa. The former is liable to root-kill.

The grape flourishes and ripens in profusion, especially in the south, whence it is shipped in large quantities.

The currant, the gooseberry, the raspberry, the blackberry and the strawberry flourish in every part of the state, requiring more favorable situations and greater care in the north. In some localities the native gooseberry has been cultivated in preference to the best eastern varieties, while European sorts have very limited success. The greatest difficulty the fruit-grower of Iowa has had, and still has to contend against, is that he has been compelled to choose between varieties all of which had originated far from his place of fruitage, and usually under conditions of soil and climate so different that the chances have been strongly against success here. It is only of late that those who have insisted that prairie regions should breed and select for themselves races of fruit from seeds planted and grown under their own peculiar conditions, have found a patient hearing. With intelligent effort along this line, the future is full of promise that the horticulture of Iowa may be brought to the high level now held by its agriculture.

An account of the introduction of the Russian fruits into Iowa and other parts of the North, will be found under *Pomology*. C. L. Watrous.

IPECAC. The root of *Cephaëlis Ipecacuanha* (now referred to *Psychotria*), a Brazilian plant not cultivated in N. America. For wild or American Ipecac, see *Gillenia stipulacea*.

IPOMŒA (according to Linn. from *ips*, bindweed, and *homoios*, like, because of its resemblance to Convolvulus; but ips is a worm). Including *Batatas, Calony-*

tion, ***Mina***, *Pharbitis* and *Quamoclit*. *Convolvulàceæ*. MORNING-GLORY. MOONFLOWER. Over 300 species of annual or perennial herbs, mostly twining, rarely trees (G.F. 7:364) or shrubs, widely distributed in tropical and temperate regions. They are remarkable for easy culture, quick growth and beautiful flowers; hence the genus includes several of our most popular plants for covering verandas and screening unsightly objects.

The generic characters of Ipomœa are not clearly defined. The list of synonyms given above is a record of unsuccessful attempts to find constant characters by which this large and variable genus may be separated into smaller and more definite groups. It is distinguished from Convolvulus, its nearest ally, by having but 1 capitate or 2–3 globose stigmas, while Convolvulus has 2 linear or ovate stigmas. Stem mostly slender, twining or climbing, sometimes prostrate, diffuse or erect; leaves alternate, entire, lobed or parted, often varying greatly on the same plant; flowers usually showy, borne singly or in cymes on axillary peduncles; corolla funnelform, salverform or bell-shaped (in one species bag-shaped), the limb sometimes entire, but usually 5-angled or 5-lobed, red, purple, blue, white or yellow, in various shades and mixtures; calyx without the bracts at the base, which appear in some species of Convolvulus, but the outer sepals are commonly larger. The flowers of most species open in early morning and last but a few hours under bright sunlight, hence the popular name. A few open only at night-fall.

"The Japanese Morning-Glories," also called "Imperial" and "Emperor" Morning-Glories, were introduced to the American trade from Japan in 1895. They are probably selected strains of *I. hederacea*, although some botanists consider them to be of hybrid origin, possibly *I. hederacea* × *rubro-cærulea*. Maximowicz referred them to *I. hederacea*, and this appears to be the more reasonable disposition. The culture of the "asagoa" in Japan amounted to a popular craze about 1830, the equivalent of $14 to $18 sometimes being paid for a single seed of the rare sorts. With political disturbances came a decline of interest, but more recently the popular fancy for Morning-Glories has again revived. The Japanese gardeners grow their plants almost entirely in pots, and by constant attention have made them vary into many curious oddities in flower and foliage. Several finely illustrated books on the Morning-Glory alone are published in Japan. See also "Century Magazine," 55:281 (1897). The Japanese Ipomœas are sold in this country mostly in strains, each package of seed giving flowers of many forms and colors. There are some inferior strains offered, and the flowers from these are often disappointing; yet as a class the Japanese Morning-Glories are the most gorgeous and versatile of garden Ipomœas. If the seeds are notched they will generally bloom in 6 weeks from sowing.

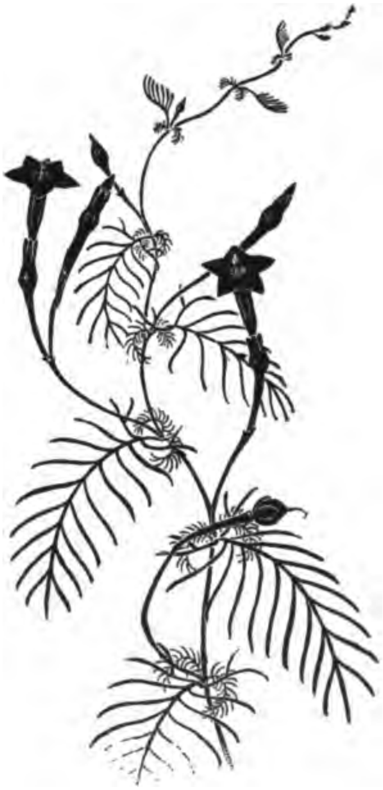
Morning-Glories are among the least exacting of garden plants as regards soil and site. Most species love a strong soil and sunny site, with plenty of water; but they will make the best of much that is uncongenial. The seeds of the annual kinds may be sown directly out-of doors, but are preferably started indoors, at least in the North. If the plants are allowed to become slightly pot-bound before being transplanted, they will come into bloom earlier. Germination may be hastened and also made more certain by filing a small notch in each seed, or by soaking the seeds in warm water about 2 hours. The "Moonflower" and the "Japanese Morning-Glories" particularly are liable to germinate poorly unless these precautions are taken.

The perennial Ipomœas are grown from seeds in some cases, but mostly from cuttings of well ripened wood, layers, or division of the rootstocks. Some of the greenhouse species, notably *I. Horsfalliæ*, rarely produce seed and are rooted from stem-cuttings with great difficulty. These are often propagated successfully by grafting well ripened shoots on pieces of their own roots, or the roots of *I. pandurata*. *I. ternata* roots from cuttings more readily, and *I. Leari* and *I. Jalapa* are easily propagated from cuttings.

The rapid growth and dense foliage of most garden Ipomœas make them especially valuable for covering arbors, verandas, walls, and for screening unsightly objects. *I. purpurea*, *I. rubro-cærulea*, *I. hederacea* and *I. Quamoclit* are the most popular annual species for this purpose; and *I. Leari*, *setosa* and *pandurata* are among the best perennials. In the South, the perennials may be carried through the winter outside by cutting off the stems and mulching the roots heavily in the fall; in the North the tubers should be taken up and wintered like Dahlias, keeping them perfectly dry in a cool greenhouse or frost-proof cellar. *I. leptophylla* is valuable for very dry soils. *I. Bona-nox* is worthy of a place in every garden.

The tender perennials are seen to advantage when trained to pillars, trellises, or along the roof of a greenhouse. Their roots should be given plenty of room to forage and their tops to spread. *I. Horsfalliæ* and its closely related species, *I. ternata*, are very satisfactory for this purpose. After flowering the strong shoots should be cut back and the plant rested. Several species, particularly *I. Leari*, *rubro-cærulea* and *hederacea*, make excellent pot-plants if they are kept somewhat pot-bound to induce flowering. The roots of nearly all the perennial species are more or less purgative; particularly *I. Purga*, from which comes the Jalap of commerce, *I. Jalapa* and *I. cathartica*. *I. Batatas* is the common sweet potato.

The trade names of Ipomœas are endlessly mixed. Thus, *I. Mexicana* of the catalogues may be *I. hederacea*, *I. digitata*, *I. Jalapa*, *I. Bona-nox*, *I. Leari* or *I. rubro-cærulea*; but is rarely the true *I. Mexicana* of Gray. "Moonflower" is often applied indiscriminately to several species of Ipomœa, but it should be restricted to *I. Bona-nox* and *I. grandiflora*. It is evident that most of the plants now sold as *I. grandiflora* are forms of *I. Bona-nox*; but a few of the smaller and inferior types are the true *I. grandiflora* of Lamarck. *I. hybrida* is a trade name for strains of *I. purpurea* and *I. rubro-cærulea*. The "Tree Ipomœa" is *I. fistulosa*. The "Japanese" or "Imperial" Morning-Glories may be referred to *I. hederacea*. Other popular catalogue



1166. Ipomœa Quamoclit (× ⅓)

names are: Double Morning-Glory is mostly *I. purpurea, fl. pl.;* Brazilian Morning-Glory is *I. setosa;* Hardy or Perennial Moonflower is *I. pandurata;* Ipomœa Heavenly Blue is *I. rubro-cærulea.*

INDEX.

angustifolia, 6.
Batatas, 25.
Bona-nox, 21.
Bona-nox, 22.
Bonariensis, 15.
Briggsii, 12.
chrysantha, 23.
chryseides, 23.
coccinea, 7.
Dickensoni, 3.
digitata, 11.
dissecta, 9.
Ferrandiana, 4.
ficifolia, 15.
filicaulis, 6.
fistulosa, 16.
Goodelli, 16.
grandiflora, 22.
grandiflora, 21.
hederacea, 4.
hederifolia, 7.
Hookeri, 8.
Horsfalliæ, 12.
Huberi, 3.
hybrida, 3, 8.
insignis, 11.
imperialis, 4.
Jalapa, 20.
kermesina, 3.
Leari, 19.
leptophylla, 17.
limbata, 4.
Lindheimeri, 10.
Lindleyana, 10.
lobata, 1.
maritima, 24.
Mexicana, 4, 5, 8, 10, 11, 20, 21.
Michauxi, 20.
Nil, 4.
noctiflora, 21.
noctiphyton, 21.
palmata, 11.
pandurata, 18.
paniculata, 11.
Perringiana, 15.
Pes-capræ, 24.
Purga, 26.
purpurea, 3.
Quamoclit, 2.
rubro-cærulea, 8.
Sellowii, 15.
setosa, 14.
sinitata, 9.
sinuata, 9.
ternata, 13.
Texana, 16.
Thompsoniana, 13.
varia, 3.
versicolor, 1.
violacea-striata, 3.
Wolcottiana, 27.

A. *Plant annual: roots not tuberous.*
  B. *Fls. numerous, in long scorpioid racemes; corolla a bag-shaped tube, contracted at the mouth* .... 1. **versicolor**
  BB. *Fls. borne singly or few in loose cymes; corolla expanded into a limb.*
    C. *Lvs. pinnately divided into many thread-like segments* .... 2. **Quamoclit**
    CC. *Lvs. entire or lobed, not divided.*
      D. *Stem hairy.*
        E. *Lvs. broad-ovate, cordate, entire* .... 3. **purpurea**
        EE. *Lvs. angulate or deeply 3-lobed* ..... 4. **hederacea**
        5. **Mexicana**
      DD. *Stem not hairy.*
        E. *Lvs. linear or lanceolate, sub-sessile* ... 6. **angustifolia**
        EE. *Lvs. ovate-cordate to hastate; petioled.*
          F. *Fls. usually less than 1 in. across; scarlet or orange.* 7. **coccinea**
          FF. *Fls. usually over 3 in. across; red, blue or purple* .. 8. **rubro-cærulea**
AA. *Plant perennial, with large fleshy rootstocks.*
  B. *Lvs. palmately divided into 3-7 segments.*
    C. *Stem and petioles hairy* .. 9. **sinuata**
    10. **Lindheimeri**
    CC. *Stem and petioles not hairy.*
      D. *Peduncles longer than the petioles*...........11. **digitata**
      DD. *Peduncles equaling the petioles.*
        E. *Fls. red: leaf segments sessile, tapering to both ends, margin wavy*......12. **Horsfalliæ**
        EE. *Fls. white: leaf segments stalked, not tapering to the ends, margin not wavy*..13. **ternata**
  BB. *Lvs. entire, angulate or lobed, not divided.*
    C. *Stem, lvs. and peduncles densely hairy.*
      D. *Corolla salverform, the lobes pointed: leaf lobes acuminate, sinuately toothed*........14. **setosa**
      DD. *Corolla funnelform, the lobes obtuse: leaf lobes unequal, blunt, entire.*15. **Bonariensis**
    CC. *Plant not hairy.*
      D. *Stem erect or ascending, not trailing or climbing.*
        E. *Lvs. cordate to subsagittate, long-petioled, acuminate, pubescent beneath*..16. **fistulosa**
        EE. *Lvs. linear, very short-petioled, acute, not pubescent beneath*.......17. **leptophylla**
      DD. *Stem trailing, climbing, or twining.*
        E. *Lvs. pale beneath.*
          F. *Fls. white, with purple throat*...18. **pandurata**
          FF. *Fls. lilac to dark purple*..........19. **Leari**
        EE. *Lvs. not pale beneath.*
          F. *Fls. opening at night*...........20. **Jalapa**
          21. **Bona-nox**
          22. **grandiflora**
          FF. *Fls. opening in the morning.*
            G. *Corolla yellow.*23. **chryseides**
            GG. *Corolla purple.*
              H. *Lvs. notched at the end.*24. **Pes-capræ**
              HH. *Lvs. acute or acuminate.*25. **Batatas**
              26. **Purga**
AAA. *Plant perennial by a woody stem.* 27. **Wolcottiana**

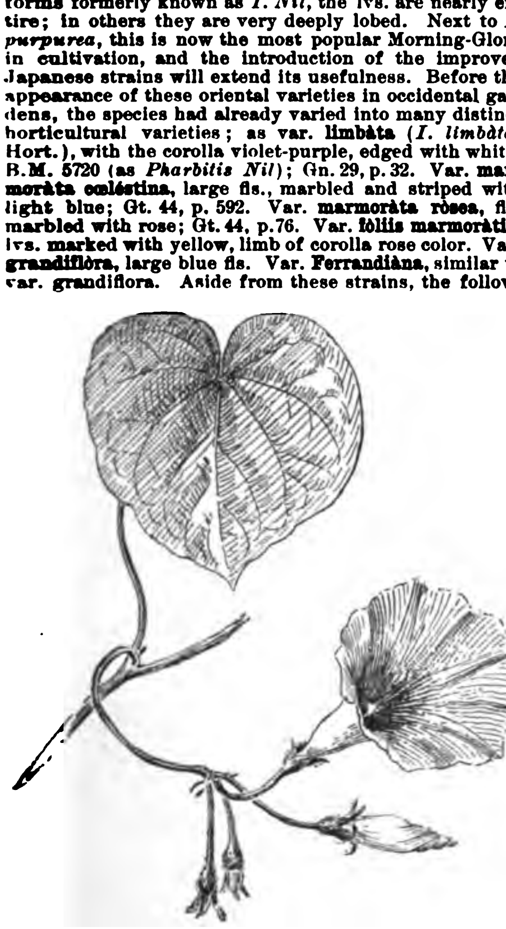
1. **versicolor**, Meissn. (*Mìna lobàta*, Llav. et Lex.). A vigorous climber, 15–20 ft. high: lvs. with a cordate base, 3-lobed, the middle lobe longest and narrowed below: fls. ½–¾ in. wide, opening rich crimson, soon fading to pale yellow. July–Sept. Mex. Gn. 30, p. 436. 437; 39:792. R.H. 1887, p. 19. G.C. II. 26:684, 685. P.M. 16:100. V. 10:34, 35. B.R. 28:24.—Distinguished from all other Ipomœas by its bag-shaped corolla and scorpioid inflorescence. It is a very free bloomer, and deservedly popular.

2. **Quámoclit**, Linn. (*Quámoclit vulgàris*, Choisy). CYPRESS-VINE. INDIAN PINK. Fig. 1166. Stem smooth, slender, twining to a height of 10–20 ft.: lvs. short-petioled or sessile: peduncles few-fld., commonly much longer than the petioles: corolla 1–1½ in. long, scarlet, the tube narrowly funnelform, inflated above; the limb nearly flat, 5-lobed. July–Oct. Naturalized from tropical America, Va. to Fla., west to Kan. and Tex.; sparingly escaped from cultivation farther north. B.M. 244. Gn. 29:33. — Beautiful in flower and foliage. Var. **álba**, Hort., has white fls.

3. **purpùrea**, Roth. (*Convólvulus màjus*, Hort. *Convólvulus purpùreus*, Linn.). TALL MORNING-GLORY. Fig. 1167. Stem trailing or twining for 4–10 ft., branching from the base: peduncles slender, 1–5-fld., often longer than the petioles: corolla 1–2 in. long, light blue, purple, pink and diversely variegated. July–Sept. Trop. America. Escaped from gardens to waste places, Can. to Fla., west to Neb. and Tex.; widely distributed in most trop. regions. B.M. 113, 1005, 1682. Gn. 21, p. 295; 27, p. 473.—One of the most popular of garden annuals. Some of its varieties resemble the entire-leaved forms of *I. hederacea*, but may be distinguished by their longer and more slender peduncles, umbellate pedicels, and oblong-acute sepals without the long tip usually found on *I. hederacea*. Seeds ripen freely on cultivated varieties and may be gathered for future sowings. Among the host of garden forms are: **álba**, white; **atro-cærùlea**, dark blue; **atrosanguínea**, dark purple; **azùrea**, sky-blue; **carminàta**, light crimson; **Dickensoni** (*Phárbitis hìspida*, var. *Dickensoni*), azure-blue; **Hùberi** (*I. Hùberi*, var. *variegàta*, Hort.). Lvs. marked with silvery white, fls. variously colored and margined with white; **kermesina** (*I. kermesina*), scarlet; **ròsea**, blush rose;

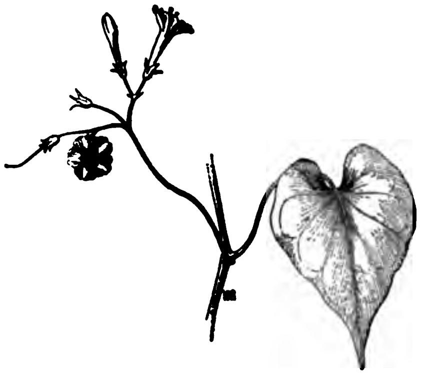
vària, a trade name for packages containing a mixture of many kinds; **violàcea-strìàta**, violet-purple. There are several double forms of *I. purpùrea*. Var. **fl. pl.** has very large lvs.: fls. appearing much later than single varieties, semi- or much-doubled, bluish white streaked with light blue or pink. Int. 1892. Said to be very floriferous and a good pot-plant. G.F. 5:593. A.G. 14:246. Var. **violàcea fl. pl.**, Hort., is entirely distinct from the preceding. Gt. 47, p. 133.

4. **hederàcea**, Jacq. (*I. Nil*, Roth. *I. scàbra*, Hort.). Stem twining or climbing, 2–8 ft.: lvs. 2–5 in. long, ovate-cordate, the lobes ovate to ovate-lanceolate, entire, or the lateral lobes repand or denticulate; the middle lobe narrowed at the base: peduncle 1–3-fld., mostly shorter than the petiole: corolla funnelform, the tube usually white, the limb light blue, purple or rose, and in various combinations of these colors; sepals hairy, lanceolate, with long and often recurved tips. July–Oct. – Widely naturalized from trop. America in fields and waste places, Pa. to Fla., west to Neb. and Mex. Perhaps native in the South. B.R. 1:85; 4:276 (as *I. cærulea*). B.M. 188 (as *Convolvulus Nil*). Gn. 27, p. 473. This species shows great variation in the form of its lvs., both on the same plant and on different plants. In some forms formerly known as *I. Nil*, the lvs. are nearly entire; in others they are very deeply lobed. Next to *I. purpurea*, this is now the most popular Morning-Glory in cultivation, and the introduction of the improved Japanese strains will extend its usefulness. Before the appearance of these oriental varieties in occidental gardens, the species had already varied into many distinct horticultural varieties; as var. **limbàta** (*I. limbàta*, Hort.), with the corolla violet-purple, edged with white. B.M. 5720 (as *Pharbitis Nil*); Gn. 29, p. 32. Var. **marmoràta cœléstina**, large fls., marbled and striped with light blue; Gt. 44, p. 592. Var. **marmoràta ròsea**, fls. marbled with rose; Gt. 44, p. 76. Var. **fòliis marmoràtis**, lvs. marked with yellow, limb of corolla rose color. Var. **grandiflòra**, large blue fls. Var. **Ferrandiàna**, similar to var. grandiflora. Aside from these strains, the following named varieties of Japanese Ipomœas are offered: Antigone, lvs. variegated: fls. blue, with pink throat. Aglaia, lvs. variegated: fls. crimson, with white throat. Aseria, fls. dull copper-red. Ceres, like Aglaia, but fls. edged with white. Euphrosyne, lvs. variegated: fls. pure white, with pink throat. Princess, fls. spotted with carmine. Gt 47, p. 133. A form with foliage dotted with white is shown in I.H. 43, p. 75. The various strains give fls. which are diversely scalloped, ruffled, fringed, doubled, and show a wonderful range of coloring.



1167. Morning-Glory, Ipomœa purpurea (× ⅓). No. 3.

5. **Mexicàna**, Gray. Like *I. hederacea*, but young lvs. entire or slightly angulate, becoming deeply 3-lobed and cordate, as in hederacea, the middle lobe broadest: peduncles as long or longer than petioles: corolla 1 in. wide, violet-purple, sometimes with crimson plaits.—Possibly this should not be distinguished from *I. hederacea*. The plants in the trade as *I. Mexicana* are mostly *I. hederacea, digitata* and *Bona-nox*. *I. Mexicana vera*, Hort.; *I. Mexicana grandiflora alba*, Hort., and *I. Mexicana grandiflora hybrida*, Hort., are *I. Bona-nox* or *I. grandiflora*.



1168. Ipomœa coccinea (× ½). No. 7.

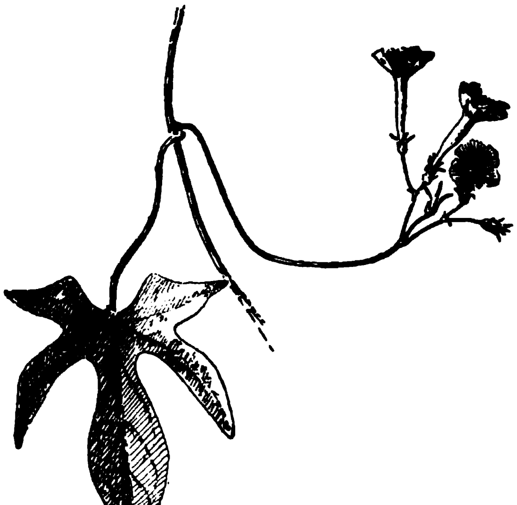
6. **angustifòlia**, Jacq. (*I. filicaùlis*, Blume). Stem prostrate, trailing or rarely climbing, much-branched: lvs. 1–3 in. long, less than 1 in. wide, glabrous: peduncles exceeding the petioles, bearing 1–2 small, bell-shaped fls., which are yellowish white with a purple eye. Aug., Sept. Widely distributed in tropical Asia, Africa and America. B.M. 5426. B.R. 4:317 (as *I. denticulata*).—Sometimes grown in the warmhouse, but there is hardly enough foliage to set off the pretty dark-eyed flowers.

7. **coccìnea**, Linn. STAR IPOMŒA. Fig. 1168. Stem freely twining for 10 ft.: lvs. slender-petioled, entire or angulate, acuminate: peduncle 2–6 in. long, few- to several-fld.: corolla ⅓–⅔ in. wide, salverform: limb obscurely lobed, scarlet with a yellow throat. Aug.–Oct. Apparently naturalized from tropical America, on river banks in the middle and south Atlantic states; probably indigenous to northern Mex. and Ariz. B.M. 221.—Fls. are produced in abundance, but are disappointingly small. In var. **lùtea**, Hort., the fls. are entirely orange, or with a tinge of scarlet.

Var. **hederifòlia**, Gray (*I. hederifòlia*, Linn. *Mina sanguinea*, Hort.). Fig. 1169. This Plains form of the species has angulate, 3-lobed or even 3–5-parted lvs., and fls. usually larger. B.R. 1:9. B.M. 1769. I.H. 41, p. 159.—It is superior to the type for ornamental purposes.

8. **rubro-cærùlea**, Hook. (*I. Hoòkeri*, Hort.). Stem tinged with purple, branched, 10–20 ft. high: lvs. membranaceous, much-veined, short-acuminate: peduncle fleshy, 3–4-fld.: fls. 3–4 in. wide, the tube white and limb red before expanding, at length purple or china-blue. Aug.–Oct. Mex. R.H. 1855:441 (as *Pharbitis rubro-cærulea*). B.M. 3297. P.M. 3:99. Gn. 27:493.—One of the most beautiful of annual climbers. The fls. are often dashed, blotched and shaded with rose, or are entirely rose. It is likely to run to vine when out-of-doors unless the roots are confined in a box or pot to induce early flowering. It makes an excellent pot-plant for the greenhouse. Var. Heavenly Blue, from Calif., was said to be a cross between *I. Leari* and *I. versicolor*, but proves to be a blue form of *I. rubro-cærulea*, which is especially valuable for cut-fls. Var. **àlba**, Hort., has pure white flowers.

9. **sinuàta**, Ort. (*I. dissécta*, Pursh, not Willd. *I. sinitàta*, Hort.). Stem somewhat woody at base, covered with long yellowish hairs: lvs. smooth or nearly so, palmately 7-parted, the divisions lanceolate or narrowly oblong, more or less sinuately cut and toothed: peduncles 1–2-fld., longer than the petioles: fls. 1–2 in. wide, bell-shaped, white with purple center; calyx as long as the corolla tube. June–Sept. Trop. Amer., and near the coast from Ga. to Tex.—In Tex. it expands only 2–3 hours at midday, and is there called the "Noon-flower." It may be treated as a coolhouse evergreen, and is worth growing for its delicate foliage alone. In the North the tubers must be wintered in a cellar.



1169. Ipomœa coccinea, var. hederifolia (× ½). No. 7.

10. **Lindheimeri**, Gray (*I. heterophýlla*, Torr., not Orteg). Plant finely pubescent, hoary when young: lvs. deeply 5-cleft or 5-parted, all of the lobes or the 3 interior ones ovate to ovate-lanceolate, with a much contracted base: peduncle 1–2-fld.: corolla long-funnelform, about 3½ in. long, light blue. Rocky soils, W. Tex. to N. Mex.—Var. **Lindleyàna**, Hort. (*I. Lindleyàna*, Hort.), has smaller lvs., lighter colored fls., and is a more profuse bloomer. An improvement on the type, but more tender.

11. **digitàta**, Linn. (*I. paniculàta*, R. Br. *I. palmàta*, Hort., not Forsk.). Stem trailing or climbing, 20–40 ft.: lvs. 3–7 in. wide, 5–7-parted, the segments elliptic, sometimes spatulate, entire: fls. numerous, in a 2-branched cyme; corolla 1½–3 in. wide, broadly bell-shaped, 5-lobed, pinkish purple or pink: seeds with a dense tuft of dirty white wool springing from the apex. July–Sept. Tropics of both hemispheres. R.H. 1853:381. B.R. 1:62 and 4:333 (as *I. Platensis*). B.M. 3685 (as *I. Platensis*). Gng. 2:311.—One of the best tuberous-rooted Ipomœas for the garden or warmhouse. In the North it may be used with fine effect if grown in a tub and trained to an adjacent pillar or trellis, the vine being cut off before frost and the tub stored. Further south the tubers may be planted directly in the open, and will give a profusion of bloom nearly all summer.

Var. **insignis**, Hort. (*I. insignis*, Ker.). Lvs. not palmately divided, nearly entire or lobed, the under surface sometimes purplish. B.M. 1790. B.R. 1:75.—There are few plants of var. *insignis* in cultivation.

12. **Horsfálliæ**, Hook. Fls. many, in a 2-branched cyme; corolla bell-shaped, the limb of 5 broad, rounded lobes, very showy. Cosmopolitan tropics. B.M. 3315. P.M. 3:50. F.S. 16:1647. K.W. 1:29.—Perhaps the most popular Ipomœa for winter-flowering in a warmhouse. If well treated it will climb 20–30 ft., and will bear hundreds of fls. each day in early winter. *I. Horsfalliæ* may also be grown out-of-doors, but it will not come into bloom till late fall unless the roots are cramped. Var. **álba**, Hort., is *I. ternata*; **Lady Slade** has pale rose fls.; var. **Briggsii** (*I. Briggsii*, Hort.), or **Lady Briggs**, is generally considered better than the type for most purposes. It is a freer grower and bloomer, the fls. are a rich magenta-crimson, and it roots from cuttings much more readily than *I. Horsfalliæ*. This variety makes a fine plant in a 10-in. pot. G.M. 37:49. Var. *Thómpsoni*, or *I. Thomsoniàna*, Hort., is *I. ternata*.

13. **ternàta**, Jacq. (*I. Horsfálliæ*, var. *álba*, Hort *I. Horsfálliæ*, var. *Thomsoniàna*, Hort. *I. Thomsoniàna*, Mast.). Stem somewhat woody at base: lvs. usually 3-parted, the segments elliptic or elliptic-oblong, fleshy, smooth: fls. trumpet-shaped, about 2 in. across. Otherwise like *I. Horsfalliæ*, of which it is often considered a variety. Probably from W. Indies. G.C. II. 20:817. F. 1884:118. Gn. 35, p. 440.—Not considered quite as effective for greenhouse culture as *I. Horsfalliæ*.

14. **setòsa**, Ker. Brazilian Morning-Glory. Plant very vigorous, branching, covered with stiff purplish hairs: lvs. 3–10 in. wide, cordate, angular or 3-lobed, the middle lobe abruptly contracted below into a narrow neck: peduncles many-fld., longer than the petioles: fls. 2–4 in. wide, salverform, rose-purple. Aug.–Oct. Braz. B.R. 4:335.—An excellent free-growing climber for covering arbors, and especially valuable for making a dense screen because of its very leafy habit. In the latitude of New York seeds sown in the open will give flowering plants in late August. It may also be treated as a warmhouse deciduous twiner. Var. Northern Light is said to be a cross with *I. Bona-nox*. Plant unusually vigorous, often growing 40–50 ft.: fls. lavender-pink.

15. **Bonariénsis**, Hook. (*I. ficifòlia*, Lindl. *I. Perringiàna*, Dammer. *I. Séllowii*, Penny). Stem branching, tinged with purple and covered with short stellate hairs: lvs. deeply cordate, 3–5-lobed, the middle lobe longest: peduncles several-fld., longer than the petioles: fls. 1½–2 in. wide, violet to lilac, the limb spreading into 5 crenate lobes. August–October. Trop. America and Africa. B.M. 3665. B.R. 27:13. P.M. 9:25. Gt. 47:1446.—Here belongs *I. Sellowii*, Penny, and probably Hort., not *I. Selloi*, Mart., which is a distinct species.

16. **fistulòsa**, Mart. (*I. Texàna*, Coulter). Stem 4–10 ft. high, subshrubby, branching, smooth or minutely pubescent: lvs. 4–6 in. long, thickish, entire or nearly so: peduncles 1–2 in. long, mostly shorter than the petioles, few–many-fld.: corolla about 3 in. long, bell-shaped, pink-purple. July–Sept. Brazil; now escaped from gardens in Mex. and southern United States.—It is known to the trade chiefly as var. **Goodélli** (*I. Goodélli*, Hort.). This var. has lavender-pink fls., with a darker throat, and is apparently more floriferous and desirable than the type. It produces seed sparingly, but is easily rooted from cuttings. In the South it is hardy if the stem is cut down and the roots mulched: in the North, the roots must be brought indoors. Advertised as the "Tree Ipomœa."

17. **leptophýlla**, Torr. Bush Moon-Flower. Stem 2–5 ft. high, with many slender, recurving branches: lvs. 2–4 in. long, entire: peduncle stout, 1–4-fld., usually shorter than the lvs.: corolla about 3 in. across, funnelform, rose-pink, deepening to purple in the throat. Aug.–Oct. Dry plains, Neb. and Wyo., south to Tex. and N. Mex.—This species is adapted for very dry places because of its enormous tuberous rootstocks, which often weigh 100 lbs. and extend into the subsoil for 4 ft. It sometimes thrives where no rain has fallen for one to three years. The plant is beautiful when in flower.

18. **panduràta**. Man-of-the-Earth. Wild Potato-vine. Stem 2–12 ft. long: root very long and large (10–20 lbs.): lvs. 2–4 in. long, long-petioled, usually cordate and entire, occasionally angulate, fiddle-shape or hastately 3-lobed: peduncles 1–5-fld., commonly a little longer than the petioles: corolla 2–4 in. wide, broadly funnelform with pointed lobes, white with a dark purple throat. May–Sept. Dry soils, Can. to Fla., west to Mich. and Tex. A.G. 12:637. R.H. 1893:574. B.M. 1603 (as *Convolvulus candicans*), 1939, and Gn. 27, p. 373

(both as *C. panduratus*). B.R. 7:588.—In some places this species is a very troublesome weed, which is almost impossible to exterminate because of its long tuberous roots. It can easily be kept within bounds in the garden with a little care, and makes a very desirable plant for covering an old dead stump or back fence. The chief merit of *I. pandurata* as a garden plant is its hardiness; hence it is often sold as the "Hardy" or "Perennial Moonflower." If well mulched the roots will stand 26° below zero. There is a double-fld. form.

19. **Leàri**, Paxt. Blue Dawn Flower. Stem a very rapid grower, often 30–40 ft. long, somewhat shrubby at the base: lvs. 3–6 in. long, cordate, acute, mostly entire or slightly 3-lobed, variable: fls. borne in clusters of 12–30, opening in succession; corolla 4–5 in. broad, bell-shaped, deep lilac, sometimes dark purple with five lighter plaits. Very beautiful. Aug.–Oct. Tropics of both hemispheres. P.M. 4:267. B.M. 3928 (as *Pharbitis Leari*). B.R. 27:56 (as *Pharbitis Leari*).—A magnificent species for the warmhouse, but not usually satisfactory outside, at least in the North. One plant is on record as producing 60,000 fls. at the rate of 300 a day. When grown in the open the fls. are likely to be an unattractive coppery purple.

20. **Jalàpa**, Pursh (*I. Michaùxi*, Sweet). Stem 6–8 ft. high, branched, slightly rough, springing from an oblong root weighing 4–30 lbs.: lvs. 3–5 in. long, ovate-cordate, membranaceous, veiny, repand or deeply lobed, pubescent beneath, variable: fls. 3–4 in. wide, the corolla bowl-shaped, with a narrow tube, rose, white or rose-purple. Aug.–Oct. Mex. L.B.C. 6:518 (as *Convolvulus Jalapa*). B.M. 1572 (as *Convolvulus Jalapa*). B.R. 4:342; 8:621.—A very ornamental warmhouse climber and valuable for the garden if the tubers are started in the greenhouse before being set out; otherwise the plant seldom blooms much before frost. The "Jalap" of commerce does not come from this plant, but from *I. Purga*. The roots of *I. Jalapa* are but slightly purgative.

21. **Bòna-nóx**, Linn. Moonflower. Fig. 1170. Stem 10–20 ft. high: lvs. 3–8 in. long, cordate to hastate, entire, angular or 3-lobed, acute, glabrous: peduncles 2–6 in. long, 1–7-fld., equaling the petioles: corolla 3–6 in. long, 4–6 in. wide, trumpet-shaped, pure white, sometimes with greenish plaits: fls. fragrant, usually closing in the morning, sometimes remaining open till noon. Aug.–Sept. American and Asiatic tropics. B. M. 752. B. R. 11: 889 (as *I. latiflora*). Gn. 21, p. 259; 27, p. 473. V. 10: 359. Known in gardens chiefly as var. **grandiflòra**, Hort. (*I. grandiflòra*, Roxb. and Hort., not Lam.), which does not differ materially from the type. Most of the large-fld. and very fragrant forms in cultivation may be referred here; the smaller forms are probably *I. grandiflora*, Lam. Var. **grandiflora** is also sold under the following names: *I. Childsii*, *I. noctiphyton*, *I. noctiflora*, *I. Mexicana grandiflora*, *I. Mexicana grandiflora alba*, *I. Mexicana grandiflora vera*. These various trade names represent strains of varying excellence. A form with variegated lvs. is offered. The Moonflower is most popular as a garden plant, but it also does well trained along the roof of a low house or against a pillar. It is excellent for cut-flowers in the evening.

1170. Ipomœa Bona-nox (× ¼).

22. **grandiflòra**, Lam. (*Calonýction grandiflòrum*, Chois. *I. Bona-nóx*, Hort., not Linn.). Differs from *I. Bona-nox* in having the stem usually covered with short, sharp points: lvs. smaller, entire: peduncle much shorter (usually 1–2 in.): fls. not over 3 in. wide; sepals elliptic, obtuse (in *I. Bona-nox* ovate, mucronate): seeds shortly villose, with shaggy margins (in *I. Bona-nox* smooth). Cosmop. trop.—Some of the inferior strains passing as *I. Bona-nox* and its synonyms belong here.

23. **chryseìdes**, Ker. Stem slightly woody, much twining, smooth or branches slightly hairy: lvs. 1–2 in. long, ovate-cordate to subhastate, acute, entire or toothed, 3-angled, 3-lobed and repand: peduncles 1–7-fld., longer than the petioles: corolla ½–¾ in. wide, funnel-shaped. July–Oct. Trop. Asia and Africa. B.R. 4:270.—It can be grown out-of-doors, but is tardy in blooming. Best treated as a warmhouse evergreen climber. *I. chryseides* is advertised abroad. *I. chrysántha*, Hort., described in American catalogues as having rich, glossy foliage and golden yellow fls., may belong here.

24. **Pes-càpræ**, Roth (*I. marítima*, R. Br.). Stem creeping, seldom twining, 20–60 ft.: roots often 12 ft. long and 2 in. thick: lvs. 1–4 in. long, fleshy, roundish, often broader than long, with 2 glands at the base and prominently pinnate-veined: peduncles usually few-fld., equaling the petioles: corolla nearly 2 in. long, bell-shaped, margin scarcely lobed. Aug.–Oct. Trop. coasts of both hemispheres; drifting sands of coast, Ga. to Tex. B.R. 4:319.

25. **Batàtas**, Poir. (*Batàtas édulis*, Chois.). Sweet Potato. Lvs. ovate-cordate, usually angular or lobed, variable, petioled: peduncles equaling or exceeding the petioles, several-fld.: corolla 1–2 in. wide. Origin unknown, unless it be from *I. fastigiata* of tropical America.—Largely cultivated in many varieties for its edible tubers. See *Sweet Potato*.

26. **Púrga**, Hayne. Lvs. sagittate-cordate, smooth: peduncles generally 1-fld., longer than the petioles: fls. rose-purple; corolla long-tubular, with a flat limb. Sept.–Oct. Trop. Amer. B.R. 33: 49 (as *Exogonium Purga*).—The "Jalap" of commerce is an active purgative made by grinding to a powder dried slices of the tuberous roots of this species. It was principally collected near Xalapa, Mex., of which Jalap is a corruption.

27. **Wolcottiàna**, Rose. Tree, 25–30 ft. high, often 1 ft. through, with slender, slightly drooping branches: lvs. ovate to ovate-lanceolate, 3–5 in. long, smooth: fls. numerous, in short racemes or corymbs; corolla about 2½ in. broad, white, broadly bell-shaped. Mex. G.F. 7: 365.—Seeds do not germinate readily.

I. aùrea. Kellogg. Lvs. trifoliolate or quinate, the leaflets rhombic, entire, sub-repand: fls. 2–4 in. across, funnelform, with a widely expanded limb, golden yellow. Cal. After No. 12 in key.

S. W. Fletcher.

IRESÌNE (Greek name for a harvest garland wound with wool: the flowers and seeds of these plants are woolly). *Amarantàceæ*. Achyranthes. From 20 to 25 species of herbs or subshrubs, in tropical and subtropical Amer. Lvs. stalked, opposite, the margins not toothed in the domestic species: fls. very small, bracteate, in axillary or terminal panicles, perfect or imperfect (plants sometimes diœcious), the perianth of one series terete, 5-parted, with ovate-oblong segments; stamens 5; style short or none, the stigmas 2 or 3: fr. a utriculus. Two or three species are in common cultivation as bedding plants, because of their highly colored lvs. and stems. The first of these to be introduced was described before the fls. were known and it was referred to Achyranthes (*A. Verschaffeltii*), but in that genus the anthers are 2-loculed, whereas in Iresine they are 1-loculed. To gardeners they are still known as Achyranthes.

Because of ease of propagation, ability to withstand sun and shearing, and the bright colors, the Iresines are amongst the most popular bedding plants. Few plants are easier to grow. Stock plants are kept over winter in a cool temperature (as in a carnation house), and in February and March they are given more heat and moisture, and cut back, to get cutting wood. Cuttings root quickly in any good cutting-bed. For mass bedding, plants are usually set 6–10 in. apart. They will not withstand frost.

Hérbstii, Hook. f. (*Achyránthes Verschafféltii*, Lem.). Lvs. broadly ovate or orbicular, obtuse and notched at the apex, purple-red, with prominent arched veins, or in the commoner variety green or green-red with yellow veins (var. *aùreo-reticulàta*). S. Amer. B.M. 5499.—This was described and figured in August, 1864, by Lemaire as *Achyranthes* (?) *Verschaffeltii* (I.H. 11:409), and later by Van Houtte as *Iresine Verschaffeltii* (F.S.

15:1601). In July, 1864, however, Hooker had published it as *Iresine Herbstii*, in honor of Mr. Herbst, of the Kew Nursery, who introduced it from the River Platte. There are horticultural varieties with Latin names.

1171. Iresine Lindeni (× ⅓).

I. Wállisii, Ort., is a small plant, with numerous small roundish lvs., which are bronze-red or dark red above and dark blood-red beneath. Probably a form of *I. Herbstii*.

Lindeni, VanHoutte (*Achyránthes acumináta*, Hort.). Fig. 1171. Lvs. ovate-acuminate or lance-ovate, with less arching or curving veins, in the original form rich, deep blood-red, but in some garden forms with light-banded veins. Equador. F.S. 17: 1737.—More pyramidal in habit than the other species, and now more common. To this species evidently belong the garden forms known as *Emersoni*, *Collensii* and *formosa*.

I. Biemuélleri, Haage & Schmidt, is probably a garden form of one of the above. It is a compact, dwarf grower, withstanding severe cutting: lvs. and twigs rose-carmine. L. H. B.

IRIARTÈA (after Bernard Iriarte). *Palmàceæ*. Tall spineless palms, with cylindrical or swollen stems supported on a pyramid of aërial roots: lvs. few, unequally pinnate; lfts. equilateral, cuneate, entire or erose, plicate; petiole channelled; sheath cylindrical: fls. small: fr. 1–2 in. long: stigmas eccentric or lateral in fr. This palm is separated from Ceroxylon by the cuneate leaflets. Species 10. Trop. S. Amer. *I. Bungeróthii* was advertised in 1895 by Pitcher & Manda as Triartea, which was presumably a typographical error for Iriartea. No description of this species is available.

Jared G. Smith.

ÍRIS (Greek, *rainbow*). *Iridàceæ*. Plate XVI. Distinguished from the other members of the tribe except Hermodactylus and Moræa by the 2-winged style branches, from Hermodactylus by the 3-celled capsule, and from Moræa by the more or less connate perianth segments. Herbs with linear or ensiform, equitant leaves and a rhizomatous or bulbous rootstalk: stem simple or branched: flowers of 6 segments, the 3 outer reflexed, and the 3 inner usually smaller and erect, always narrowed to a distinct claw, one to many in terminal heads, from spathes which are formed of the upper bract-like leaves; spathe stalked or sessile; style divided into 3 petal-like branches, which are bifid or crested at the tip; stigmatic surface immediately below the crests: ovary sessile or pedicelled, within the spathe. For a monograph of the genus, see Baker's Irideæ, 1888.

About 170 species of Iris are known to botanists. They are natives of the north temperate zone, inhabiting Asia, Europe and North America, with a few species in northern Africa. About 100 species, with innumerable garden varieties, are offered by dealers in America. Many of these, including the native species, are cultivated only to a slight extent, so that horticultural interest centers chiefly around a few groups given below:

1. *German Irises.*—The plants known to the trade, and widely advertised as *Iris Germanica*, German Iris or Fleur-de-lis, are varieties and hybrids of several species, all of which are closely related to *I. Germanica*. It is a curious fact that *I. Germanica* itself has comparatively few varieties, and forms but a small part of the group named after it. It rarely or never seeds in cultivation, even when placed near closely related species. The principal parent species are *I. Florentina*, *squalens*, *sambucina*, *flavescens* and *variegata*. Owing to their diversity of origin, the varieties have a great diversity of color, ranging from pure white (in *I. Florentina* and its derivatives) through all shades of mauve and blue to dark purple. From *I. variegata* and *I. flavescens* the yellow-flowered varieties and those whose flowers are variegated with yellow were probably derived. The flowers of all the varieties are large and handsome, often stately, exhibiting beautiful variegation and shades of color. They are borne on stout, erect, branched stalks much exceeding the clumps of spreading leaves. All are hardy, and form excellent border plants, flowering in May and June.

2. *Japanese Irises.*—All the plants cultivated as Japanese Irises are referable to a single species, *Iris lævigata*, more generally known as *I. Kæmpferi*. The type of the species has been so much broken that its varieties constitute a distinct horticultural group, containing perhaps as many or more named varieties than the *I. Germanica* group itself. So far as known, no hybrids or other species enter into the make-up of this class. The plants form strong clumps, attaining a height of 2 to 3 feet, and bearing several flower stems. The leaves are slender, erect, growing almost parallel to each other. In the wild type the inner segments are erect and rather small. Under cultivation they have been much broadened and have acquired a spreading habit, giving the flower a flat, expanded form characteristic of this group. In color they range from white through various shades of blue to deep purple, with the segments variegated with darker veins and streaks, or plain. All the varieties are hardy, and thrive best in cool, moist situations. They begin flowering in the latter part of June and continue through July.

3. *Dwarf Irises.*—The dwarf Irises comprise several species related to *I. pumila*, *verna* and *cristata*. They seldom grow over 9 inches high, but spread rapidly by their creeping rhizomes, soon forming large patches. This habit makes them useful border plants. *I. arenaria* lives well in dry, sandy situations. The flowers are variously colored blue, lilac, yellow, etc.

4. *Oncocyclus Irises.*—The interesting species of the subgenus Oncocyclus inhabit the dry mountain regions of Palestine, Persia and Armenia. They differ from other Irises in many striking characters. The plants grow from 6 to 12 inches high, the stem bearing a single flower, which in some species is of enormous size, compared with the size of the plant. The segments, of which the inner are larger than the outer, present a most singular combination of somber colors. The peculiar colors are often due to the interlacing of numerous very thin veins, usually blue or brown, on a white or straw-colored ground. The most common shades thus produced are beautiful sky-blue, light gray, and brown to almost black. In some, all the segments are colored nearly alike, but in most species the inner and outer segments are differently colored. In America this group is not widely cultivated, the most common representative being *I. Susiana*. Many recorded hybrids have been raised in Europe. For a monograph, see Foster. Gn. 43, pp. 130–135.

Bulbous Irises.—About 20 species of bulbous Irises are cultivated in America. They are rather dwarf, hardy and half-hardy bulbous plants, known chiefly for the brilliant colors and strong contrasts, and for their numerous flowers. The species most commonly found in gardens are *I. Xiphium*, better known as *I. Hispanica*, and *I. xiphoides* or *I. Anglica*. The latter is probably the oldest Iris in cultivation. See Foster, G. C. II. 23, pp. 567 and 726. H. Hasselbring.

The Irises are a widely distributed group of plants, occurring in almost all degrees of longitude of the north temperate zone. They are found in few forms above 40 degrees north latitude, and there seem to be no species south of the Atlas mountains of Africa, the botanists rating the nearly allied southern forms as Moræas. There is a somewhat general localization of some of the main forms of Irises, central to southern Europe being rich in the broad-leaved species, both tall and dwarf, these giving way in Asia to many narrow-leaved forms, which forms are also abundant on our western coast, in fact east to Missouri. Spain and the Mediterranean

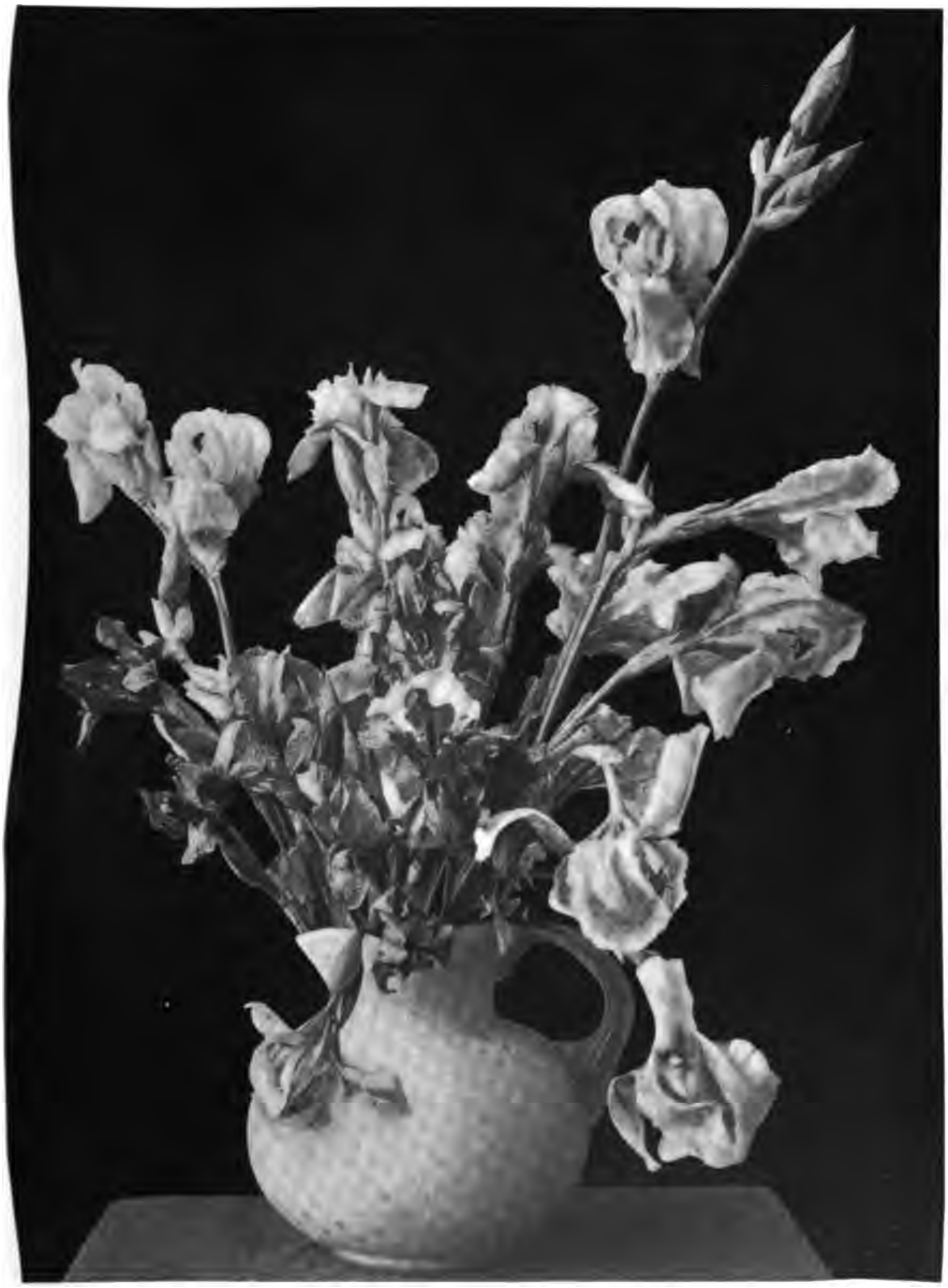


Plate XVI. Irises, mostly of the Germanica type.

regions of Africa are the home of bulbous forms. In southwestern Asia are found not only broad-leaved forms, but this region is also the home of a rich variety of dainty bulbous kinds and the curious Oncocyclus species.

As will be seen by their distribution, Irises are especially adapted by their hardiness to growth in our gardens, though some forms, as the African, the Indian, and the Oncocyclus species, need special treatment or protection. In the main the Irises, from a cultural point of view, are like others of nature's various families, mostly very good—not to say commonplace—with a few decidedly bad members. As there are nearly 170 species of Irises, with countless varieties, they are interesting to the amateur collector and grower both for their variety and their general beauty of flower.

The life of Iris flowers varies from three to six days. They are fragile, but if cut before the petals unroll may be forwarded to considerable distance without injury. This is the only way, in fact, by which the florist can market them. The botanists divide the Irises into two main groups, the bulbous kind and those with rhizomes, these groups being each divided by the varying characters of the more or less raised line in the middle of the fall of the flower. This, of course, gives no clue to cultural necessities or to time of flowering, two important details in a garden.

Considering the bulbous Irises as a group, these are all hardy without protection in the latitude of New York city except *I. Histrio*, *I. alata*, *I. juncea*, *I. Palæstina*, *I. Tingitana*, *I. Vartani*.

In the order of their flowering, the *reticulata* group is the earliest, *I. Bakeriana* and others starting into flower as soon as released by frost, usually in February or March. These are soon followed by the others of this group, the largest-flowered member being *I. histrioides*. A peaty, sandy soil seems to be most acceptable to this group, and no organic manure must be given them. A location, if possible, where they may be kept on the side of dryness in summer is desirable. The culture of these, like that of all exotic plants in our gardens, is, of course, tentative. If, on trial, they seem to be happy and increase from offsets or buds, they may remain in the borders indefinitely, but if during the second season they show no gain, the bulbs should be lifted and a trial made in another location. This group seeds freely, and the seed pods will be found just under the soil surface.

Closely following this group are the so-called Juno Irises, of which *I. Persica* is the most familiar, though not the best example. These Irises have somewhat large bulbs, with curious, persistent, fleshy roots, and seem to thrive best in somewhat stiff soil, in sheltered locations, where they will be well baked during the summer. They flower in March and April, the best forms being *I. Rosenbachiana*, *T. orchioides*, *I. Sindjarensis*, and *I. Assyriaca*. They are desirable plants in the most exclusive gardens. They seed freely, and also increase by offsets.

About the same time as above will flower the *Iris tuberosa* ("The Widow"), which is neither bulbous nor an Iris strictly, but has a weird beauty of its own, with its green and black flowers. This should have a summer baking. (See *Hermodactylus*.)

Planted out in the early fall, the so-called Spanish Irises make an early start and produce leaves which are persistent during the winter and seldom injured here. In May and June they broaden out, and are then surmounted by very bright, distinct and charming flowers. Very satisfactory flowers, these, and of the easiest culture. They probably do best in spots inclining to moisture. The bulbs make offsets rapidly, and should often be divided and replanted. There are two forms and numerous flowers of this Iris. The boldest form is that known as the "Thunderbolt."

The "English" Irises, *I. xiphioides*, follow the "Spanish" in June and July. Their flowers are wider in all their parts, and in a limited range of colors, white and purple. "Mt. Blanc," pure white, is probably the most satisfactory of the group. The foliage of the English Iris does not spear till early spring, and the varieties flourish in a rather drier position than the "Spanish."

The African bulbous Irises, *I. juncea*, *I. Vartani*, *I. alata*, are subjects for a coolhouse, though the former is rarely hardy here.

The rhizomatous Irises may be divided into a number of sections, but in a cultural way may be broadly considered in two sections: those with thick, surface-creeping rhizomes, as the hybrid German, and those with more or less thin ones, as *I. Sibirica* and *I. lævigata*, which are subterranean. While the former section comprises plants which grow in various conditions, some with the roots submerged, yet in a general way they have mostly surface-creeping rhizomes. These are best transplanted soon after flowering, at which time they commence a new growth. It is customary for the nurserymen to supply these in the fall, which usually leads to the loss of a season, as they often fail to become established when planted late. The foliage of the Iris indicates a sun-loving family, and Irises should be planted in full exposure in rich, but not manured soil, well drained. The rhizomes should be planted flat and covered to half their diameter. If the rhizomes are in a growing condition, no further care will usually be necessary with the great majority of the species, but if the rhizomes are dormant and partly dried up, as they are frequently on receipt, care should be taken that they have not much moisture till they start into growth, otherwise they are likely to rot. Not every Iris will grow in every garden, but the failure to establish these plants is most often caused by too much exposure to excitement of light, warmth and moisture when the plant is not ready to convert its reserve into food. Valuable species should have the protection of a frame in such circumstances till it seems safe to plant them out. If carefully treated and not excited, apparently hopeless dried up rhizomes may often be saved. Most of these Irises in common cultivation increase rapidly, and should be divided and replanted every two or three years; otherwise the rhizomes become matted and the abode of grass, etc. Among them will be found some of the showiest flowers of the family.

Usually in early May we have flowers of *I. Chamæiris* and its variety *I. Olbiensis*, followed quickly by the dwarfer *I. pumila* and its white form *I. Attica*. Forms of *I. lutescens*, Lam., quickly follow, after which *I. Germanica*, *I. Florentina* and the host of "hybrid German" varieties come rapidly forward and give a great wealth of color. Every one is familiar with the great bearded purple *I. Germanica*, perhaps the most generally cultivated Iris. There are larger-fld. forms of this: *I. Amas* and *I. macrantha*. *I. Germanica alba* seems to be a variety of *I. albicans*. This and *I. Florentina* are the usual white-fld. forms seen at this time. Of bold, lighter purple kinds, *I. pallida* and its hybrids are then preëminent.

The German Irises of the garden are not varieties of *I. Germanica*, but hybrids of various species, as *I. pallida*, *I. variegata*, *I. sambucina*, *I. squalens*, *I. lurida* × wild forms and *I. neglecta*, *I. amœna*, *I. plicata* and *I. Swertii*, which are known only in gardens. Naturally these vary much in stature, time of flowering, size and coloring of fls. They may be had in almost endless variety, but a typical collection may be made with comparatively few plants.

Among the best forms of the "hybrid German" Irises are: *I. aphylla*—Bridesmaid, Madame Chereau, Swertii; *I. amœna*—Compte de St. Clair, Fairy Queen, *Reticulata alba*, Victorine; *I. neglecta*—Cordelia, Wagner; *I. pallida*—Khedive, Mad. Pacquitte, Queen of May, Walmer; *I. squalens*—Amols, Jacquiniana, Harrison Weir, Mons. Cherion; *I. variegata*—Beaconsfield, Darius, Hector, Honorable, Prince of Orange.

June is flowering time for many Iris species, many of which are uncommon, but of the more available forms one could scarcely neglect the native *I. hexagona*, the dark La Mance form of which is very distinct and amongst the handsomest of the family. A white form of this is not hardy here. *I. fulva*, another native plant with copper-colored flowers, is also interesting. Irises with distinct forms of this season are *I. Monnieri* and *I. orientalis* (or *I. ochroleuca*), both of which have obliquely growing rhizomes and enjoy moisture.

For margins of water *I. Pseudacorus*, with yellow fls., is invaluable, and our natives, *I. versicolor* and *I. Caro-*

linensis, seem as happy in the moisture as in the uplands. The Iris rhizomes which require deep planting are mostly smaller and thinner than those of surface creepers. The species with these roots are mostly strong-growing plants, rapidly increasing and requiring an abundance of moisture, though there are some notable exceptions to be mentioned later. Of the members of this group, *I. Sibirica*, in several purple and white forms, is a common garden plant. *I. ensata* is a common Asiatic Iris with small fls. borne among the narrow foliage, which is as ornamental as some of the large grasses.

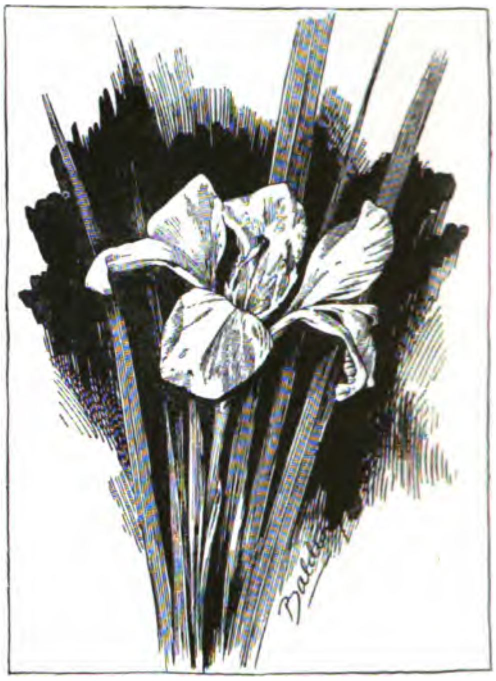
The Japanese Irises, which usually end the general display of Irises, are a remarkable example of type-breaking, the occidental gardeners having worked up from *I. lævigata* a wonderful variety of colorings and variation in number of petals, though the colors may be included in about half a dozen general types. There are few handsomer flowers than good forms of the white Japanese Iris. This Iris may be grown on the upland, but it does not do its best in such locations, for it is particularly susceptible to good treatment, and to produce large flowers both water and manure are essential. Mr. Peter Barr, the veteran fancier of good plants, lately wrote the undersigned from Japan, after consulting one of the oldest cultivators, that "this Iris is grown in the rice fields in winter and watered each month while at rest with human manure (cow manure would do); as soon as young growth appears no more manure is given and the ground is flooded. When growth has ended the water is withdrawn."

One of the most curious things in connection with the Japanese Iris is that though these plants have been in cultivation here since soon after the treaty ports were first opened, they seem to have excited little attention from gardeners until within a few years. Yet the first importations were as handsome as the later. In this connection it may be said that Japan has also *I. gracilipes*, a dark purple hardy form, and *I. Japonica* or *Chinensis*, one of the beauties of the family but, like *I. tectorum* (the Roof Iris), another crested kind, needing here greenhouse protection and well worth it. There is, however, a perfectly hardy crested Iris, the beautiful dwarf *I. cristata* of the upper southern states—a charming plant for a front border or rockery. Equally dwarf are our lake Irises *I. lacustris* and *I. verna*.

The west coast of the United States is fortunate in possessing some beautiful and distinct Irises, mostly of the wiry-rooted, thin-leaved type. They have not yet been fully separated botanically, and they are most difficult things to establish in eastern or other gardens, so that there are really very few in cultivation. Raising from seed seems the most practical way of establishing these species. They seem to be perfectly hardy here, for some of them have been tested and flowered, but they do not tarry long.

I. macrosiphon, I. Hartwegii, I. Douglasiana, I. bracteata, I. tenax, I. longipetala, I. tenuis and I. Purdyi is a list which will interest the searcher after interesting plants. Max Leichtlin, who has a genius for growing difficult things, has been successful in establishing *I. bracteata, I. macrosiphon* and *I. Purdyana*. He says, "My experience is that they cannot be moved unless in full vegetation. We must grow them from seed, and not touch the seedlings until they have formed a solid rootstock. After this and movement to grow has begun, they can be safely handled and transplanted like other Irises."

There remain to be considered two allied groups, the Oncocyclus and Regelia. These are considered by amateurs the most interesting groups of the Iris family—interesting in the amateur's vocabulary meaning something rare and difficult. At the best, these plants give few flowers, but they compensate for this by their distinct and quaint beauty. The best known member of the family, *I. Susiana*, has been in cultivation several hundred years, but is by no means yet a common plant. It takes more kindly to cultivation than any of the other species, will usually flower in the border the first year after planting if the spring is not too rigorous; and gardens are not unknown where from some conditions of fortunate placing or soil, they continue to flourish. It cannot be said that there is any hard and fast formula for growing these Irises. They vary among themselves as to their requirements, and need special and different treatment in different gardens and climates. These Irises are natives of Palestine, Asia Minor, the Caucasus, Central Asia and Persia regions, all of which are hot and dry in summer, with a settled and sometimes severely cold winter and a genial spring. In some of the regions they are protected by a covering of snow in winter while dormant, but Palestine and Persia have open winters, and their Irises make growth at this time. After cultivating most of the species for a number of seasons, the writer's experience does not lead him to dogmatize much on their cultivation or to approve of many special devices which have been put forward from time to time as the solution of the problem. The consensus of opinion among the growers who have had the best success with these plants is about as follows, premising that we are dealing with plants which are perfectly hardy: We receive the rhizomes with the Dutch bulbs in the fall, at which time they are dormant and leafless. It is well to store them in a cool place and plant out in November in a bed of fairly light and well drained soil in a border fully exposed. They require no protection, but if the climate is one where frosts and thaw alternate, it is well to give the ground a covering while frozen to keep it firm. The Irises so planted will seldom spear here till genial weather arrives, and with plentiful supplies of moisture at the root will give flowers from strong buds. After flowering, or, more accurately, flowering time, one is forced to choose between two methods of treatment. If the garden is high, dry and hot, the best procedure is to cover the beds with a glass frame sufficiently large to protect them from moisture and allow the rhizomes to bake. This frame may be removed in the late fall. If the leaves appear, as some of them are likely to do, they may be left unprotected until very severe weather sets in, here usually in December. The protection should be something to protect the leaves from the winter sun and frequent change of temperature. Here coal ashes have proved satisfactory, though unsightly. Foliage does not seem to become as soft under them as under leaves or mats. If the spring is genial, with weather



1172. Iris unguicularis.
Type of smooth-petaled Iris (× ½). No. 13.

steadily becoming warm, the plants being uncovered as soon as the conditions will seem to warrant, should be in the best possible shape to reward one with their noble blooms. It is the lack of this genial spring in the latitude of New York which, however, leads often to cultural troubles. The leaves, having been protected, are none too hard, and, with the constant alternate thawing and freezing, and the high winds, hot and cold, the plants need constant watching and application of needed covering till really genial weather. Otherwise the foliage is blighted and no flowers are produced.

In gardens which are low and never free from moisture, the best procedure is that followed in Holland, lifting the rhizomes in July and taking them under cover in dry earth, planting out again in the fall. In this case care should be used in lifting not to injure the numerous fleshy roots. The Palestine and Persian forms of these Irises are considered the most difficult to cultivate, from their habit of early growth.

Irises are not only increased by the division of the rhizomes or by offsets, but may be rapidly grown from seed, which they usually produce freely, though, in most cases, they require artificial fertilization. A large number of the common Irises of gardens are hybrids, and of late years a number of beautiful hybrids have been produced between some of the rarer Oncocyclus species, and between these also and common forms, as *I. variegata*, etc. There are still opportunities to produce many new and untried crosses, and experiments in this line are recommended. The pollination of the Iris is simple. The anthers should be removed when the flower first opens, and preserved in paper or vials, properly marked. The pollen will retain its potency for a week or perhaps longer, and may be applied to the stigma of the flower selected (the anther of which has been removed promptly) with a camel's-hair brush. The stigma will be found near the apex of the petal-like style, and is ready for pollination when the upper edge drops down and exposes the upper surface. Many Iris seeds germinate with considerable irregularity, and failure to start promptly should not lead to discouragement or discarding of the pan in which the seeds are.

J. N. GERARD.

INDEX.

acuta, 12.
alata, 99.
Alberti, 36.
albicans, 54.
amœna, 59.
Anglica, 82.
aphylla, 50, 56, 57.
arenaria, 46.
Asiatica, 55.
atrofusca, 75.
atropurpurea, 74.
atroviolacea, 37, 65.
aurea, 24.
azurea, 37.
Bakeriana, 90.
Balkana, 40.
Benacensis, 52.
biflora, 41.
biglumis, 7.
Billiotti, 63.
Bismarckiana, 72.
Bloudovii, 47.
Bohemica, 50.
Boissieri, 86.
bracteata, 14.
Caroliniana, 21.
Caucasica, 100.
Cengialti, 42.
Chamæiris, 45.
Chinensis, 35.
cœrulea, 87, 102.
concolor, 68.
cristata, 32.
cuprea, 17.
cyanea, 87.
Cypriana, 64.
Danfordiæ, 93.
Delavayi, 8.
Douglasiana, 16.
ensata, 7.
falcata, 50.
filifolia, 84.
fimbriata, 35.
flavescens, 49.
flavissima, 47.
Florentina, 54.
fœtidissima, 27.
Fosteriana, 96.
fragrans, 7, 41.
fulva, 17.
fumosa, 101.
furcata, 50.
Gatesii, 78.
Germanica, 60.
gigantea, 26.
gracilis, 10, 37, 39.
graminea, 11.
Grant-Duffii, 4.
Guldenstœdtiana, 23.
gypsea, 60.
hæmatophylla, 12.
halophylla, 30.
Hartwegii, 3.
Helenæ, 71.
hexagona, 20.
Hispanica, 81.
Histrio, 88.
histrioides, 87.
honorabilis, 48.
humilis, 1.
Hungarica, 50.
hybrida, 59.
Iberica, 76.
Italica, 45.
Jacquesiana, 60.
Japonica, 35.
juncea, 83.
Junonia, 55.
Kæmpferi, 28.
Kochii, 53.
Kolpakowskiana, 91.
Korolkowi, 68.
Krelagei, 87.
lævigata, 28.
Leichtlini, 67.
Leichtliniana, 68.
lineata, 66.
longipetala, 9.
Lortetii, 73.
lupina, 80.
lurida, 51, 70.
Lusitanica, 81.
lutescens, 44.
macrosiphon, 2.
major, 77, 87.
Mariæ, 71.
maricoides, 92.
Milesii, 34.
minor, 46.
Missouriensis, 15.
Monnieri, 25.
Nazarina, 79.
neglecta, 58.
Nikitensis, 11.
notha, 30.
nudicaulis, 41.
ochroleuca, 26.
oculata, 102.
Olbiensis, 45.
orchioides, 102.
orientalis, 12, 26.
oxypetala, 7.
pabularia, 7.
Palæstina, 98.
pallida, 18, 55.
Panormitana, 38.
paradoxa, 69.
Persica, 94.
plicata, 56.
prismatica, 10.
Pseudacorus, 18.
pseudo-pumila, 38.
pumila, 37.
purpurea, 94.
reticulata, 60, 87.
Rosenbachiana, 95.
Ruthenica, 1, 5.
sambucina, 62.
sanguinea, 12.
Sarii, 70, 79.
scorpioides, 99.
setosa, 22.
Sibirica, 12.
sicula, 55.
Sindjarensis, 97.
Sisyrinchium, 92.
Sogdiana, 23.
speciosa, 55.
spectabilis, 81.
spuria, 30.
squalens, 61.
Statellæ, 44.
stylosa, 13.
superba, 13.
Susiana, 77.
Suwarowi, 66.
Swertii, 57.
tectorum, 33.
tenax, 6.
Tingitana, 83.
Tolmieana, 15.
Trojana, 29.
unguicularis, 13.
vaga, 67.
variegata, 12, 18, 48.
Vartani, 89.
verna, 31.
versicolor, 19.
violacea, 68.
virescens, 43.
Virginica, 10.
xiphioides, 82.
Xiphium, 81.

SYNOPSIS OF SUBGENERA IN CULTIVATION.

Series I. Rootstock a short, thick, or creeping rhizome.

APOGON. Outer segments of the perianth without a beard or crest........................Species 1–30

PARDANTHOPSIS. Outer segments of the perianth not distinctly bearded or crested, merely keeled; sometimes slightly hairy...............Species 31

EVANSIA. Outer segments of the perianth distinctly crested on the claw and lower part of the blade ....Species 32–35

PSEUDEVANSIA. Outer segments bearded or hairy: beard springing from a rudimentary crest...... .... Species 36

POGONIRIS AND REGELIA. Outer segments bearded or hairy: hair restricted to a dense beard along the midrib............................Species 37–68

ONCOCYCLUS. Outer segments bearded or hairy: hairs diffused over the lower part of the blade and claw; inner segments larger than the outer. .... Species 69–80

Series II. Rootstock bulbous.

XIPHION. Inner segments of the perianth large, erect: stamens not adhering to the style branches ....Species 81–91

GYNANDIRIS. Inner segments large, erect: stamens adhering to the style branches....Species 92

JUNO. Inner segments small and spreading or deflexed ....Species 93–102

SUBGENUS APOGON

A. *Lvs. linear, generally less than ½ in. broad.*
B. *Sheath splitting up into fibers.*
C. *Valves of the spathe green.*
D. *Tube of the perianth 1½–2 in. long.*
E. *Spathe sessile*...... 1. **humilis**
EE. *Spathe stalked* ..... 2. **macrosiphon**
DD. *Tube of the perianth short or obsolete.*
E. *Fls. yellow*......... 3. **Hartwegii**
4. **Grant-Duffii**
EE. *Fls. some shade of blue or white.*
F. *Stem lvs. reduced.*
G. *Stem terete.*
H. *Rootstock slender, wide-creeping*........ 5. **Ruthenica**
HH. *Rootstock short, creeping* .. 6. **tenax**
7. **ensata**
8. **Delavayi**
GG. *Stem compressed*...... 9. **longipetala**
FF. *Stem lvs. long, generally over 1 ft. in length*....10. **prismatica**
11. **graminea**
CC. *Valves of the spathe brown and scarious*...........12. **Sibirica**
BB. *Sheaths not splitting into fibers.*
C. *Stem nearly obsolete* .....13. **unguicularis**
CC. *Stem present, clothed with sheathing bracts*.......14. **bracteata**

ccc. *Stem present, bearing 1–2 leaves* ....15. **Missouriensis**
16. **Douglasiana**
AA. *Lvs. ensiform, generally much over ½ in. broad.*
B. *Stem bearing several long leaves.*
C. *Fls. reddish brown*.......17. **fulva**
CC. *Fls. yellow* ....18. **Pseudacorus**
CCC. *Fls. blue, purple, lilac, etc., or white.*
D. *Lvs. somewhat glaucous*.................19. **versicolor**
DD. *Lvs. bright green, not glaucous.*
E. *Fls. sessile* ....20. **hexagona**
EE. *Fls. pedicelled*.....21. **Caroliniana**
22. **setosa**
BB. *Stem bearing 2–4 reduced lvs.*
C. *Fls. yellow* ....23. **Guldenstœdtiana**
24. **aurea**
25. **Monnieri**
26. **orientalis**
CC. *Fls. some shade of blue or white*..................27. **fœtidissima**
28. **lævigata**
29. **Trojana**
30. **spuria**

1. **húmilis**, M. Bieb. (*I. Ruthénica*, Ker., not Dryand.). Rhizome wide-creeping: lvs. to 12 in a tuft, glaucous, 6–12 in. long: fls. bright lilac; outer sepals with a suborbicular blade and a long cuneate claw. Caucasus to Georgia and Hungary. Gn. 10, p. 379.

2. **macrosiphon**, Torr. Plants rather dwarf, 6–12 in. high: lvs. grass-like, green, 12 in. long, exceeding the fls.: stem 3–6 in. long: pedicels very short: outer segments obovate-cuneate, undulate, pale yellow to cream, with a network of brownish crimson or bright lilac veins; inner segments rather small, colored like the outer. Free-flowering. Calif. and Ore. Gn. 52, p. 126.—Torrey says the fls. are bright lilac and the lvs. less than 4 lines wide.

3. **Hártwegii**, Baker. Lvs. few (2), 6–12 in. long, finely veined: stem 6 in. long, with linear leaf low down: pedicel 1–1½ in. long: limb pale yellow: outer segments with an oblong blade, shorter than the claw. Calif. Rarely cult.

4. **Grant-Dúffii**, Baker. Lvs. about 1 ft. long: stem 6 in. high, with about 2 lvs., outer valves marked with fine black lines: outer segments with a yellow blade, much shorter than the claw; claw veined with lilac on a yellowish white ground. Palestine. Gt. 42, Supp. Pl.—Not valuable commercially.

5. **Ruthénica**, Dryand., not Ker. Lvs. 3–12 in. long, in crowded tufts: stem slender, 3–6 in. long, but often obsolete: tube twice as long as the ovary: outer segments with an oblong blade rather shorter than the claw, lilac, violet-scented. Apr., May. China, Siberia and Cent. Asia. B.M. 1123 and 1393. Gn. 50, p. 187.

6. **tènax**, Dougl. Sheaths short: lvs. 6–12 in. long: stem 6–12 in. long: pedicel long: outer segment broadly obovate, with an acute point: blade about as long as the claw, bright lilac, with purple veins and a variegated white and yellow spot on the throat: inner segments shorter, waved. Apr., May. Dry soils, B. C. and Ore. Int. to Eng. 1826. B.M. 3343. B.R. 15:1218. Gn. 53:1175.—Hardy.

7. **ensàta**, Thunb. (*I. biglùmis*, Vahl. *I. oxypétala*, Bunge. *I. fràgrans*, Lindl.). Sheaths large: lvs. 1–3 ft. long: pedicel 2–4 in., often longer than the spathe: limb loose, bright blue or lilac: outer segments oblanceolate, 2 in. long: blade shorter than the claw, veined with dark blue, yellowish on the throat: inner segments slender, erect, bright blue. Russia, Japan, Caucasus. B.M. 2528 and 2331. B.R. 26:1. Gt. 1011.—Hardy. Variable.

Var. **pabulària**, Naudin (*I. pabulària*, Hort.). Said to be distinct. Larger, with lvs. purplish red near the base. Used as a forage plant. Does well in driest situations. Gt. 47:1452.—Described by Wittmack, Gt. 47, p. 369. The seeds should be sown in beds, and the young plants set out the following spring, 10 in. apart each way, where they are to remain.

8. **Delavàyi**, Micheli. Lvs. 2–2½ ft. long, often nearly 1 in. broad: stem 3–5 ft. high, bifurcate: spathe valves green: outer segments reflexed from the middle, oblong, obtuse or emarginate, brilliant violet, spotted with white on the lower half; claw yellow, veined with lilac; inner segments oblong-lanceolate, acute, erect, violet. Large plants, with the flower-stalks erect, high above the lvs. Thibet. R.H. 1895, p. 399.

9. **longipétala**, Herb. Lvs. 1–1½ ft. long: stem stout, solid, compressed, 1½ ft. high: fls. bright lilac; outer segments obovate, reflexing half way down; claw veined with violet on a white ground. Calif. B.M. 5298.

10. **prismática**, Pursh (*I. Virgínica*, Muhl. *I. grácilis*, Bigel.). Plant tall, slender: lvs. mostly shorter than the stem, grass-like: stem 1–2 ft., simple or forked, flexuous: spathes 1–2-fld.: pedicel long, exceeding the spathe: outer segments 1½–2 in. long; blade shorter than the claw, bright lilac, yellow on the throat, marked with purple and darker veins; inner segments erect, bright lilac. May, June. Wet grounds, New Brunswick to Pa. and N. Car. B.M. 1504.

11. **graminea**, Linn. (*I. Nikiténsis*, Lange). Lvs. strongly ribbed, 1–1½ ft. long: stem compressed, angled, slender, solid: pedicel 1–1½ in. long: limb bright lilac, copiously veined; outer segments with an orbicular blade ½ in. broad and shorter than the broad claw: claw dull yellow, veined with purple; inner segments erect, nearly straight. May. Central and S. Eu. B.M. 681.—Long cult.; mentioned by Lobel, Clusius and Gerarde. Distinguished from *I. Sibirica* by its solid, angular stem.

12. **Sibírica**, Linn. (*I. acùta*, Willd.). Compact, tufted: lvs. green, not rigid, 1–2 ft. long: stem slender, terete, fistulose, much overtopping the lvs., simple or forked, bearing several clusters of fls.: limb bright lilac-blue; outer segments 1½–2 in. long, with an orbicular blade gradually narrowed to a slender claw, veined with bright violet, whitish toward the claw; inner segments shorter, erect. Central and S. Eu. and eastern Siberia. Int. in 1796. B.M. 50. R.H. 1898, p. 23.—Common in cult. The plants form large, compact clumps, producing many long flowering stems from the center. Var. **orientàlis**, Thunb. (*I. sanguínea*, Don. *I. Sibírica*, var. *sanguínea*, Hort. *I. hæmatophýlla*, Fisch. *I. Sibírica*, var. *hæmatophýlla*, Hort.). Fls. larger, more fugitive; blade of the outer segments orbicular: young lvs. reddish. June. Produces a second crop later. Var. **álba**, Hort., with pure white fls. Var. **variegàta**, Hort., with variegated lvs. Var. **acúta**, Hort. Narrow-lvd.

13. **unguiculàris**, Poir. (*I. stylòsa*, Desf.). Fig. 1172. Lvs. about 6 in a tuft, finally 1½–2 ft. long, bright green: tube 5–6 in. long, filiform, exserted from the spathe: limb bright lilac, rarely white; outer segments 2½–3 in. long, 1 in. broad, with a yellow keel, streaked with lilac on a white ground at the throat; inner segments oblong. Jan., Feb. Algeria. B.M. 5773. Gn. 24:398; 46:979; 49, p. 236; 50, p. 187. G.C. III. 25:85.—Not hardy, but useful for cutting in early winter. Fragrant. Var. **álba**, Hort. White form; spring. Var. **supérba**, Hort. Bluish purple. Oct. and later.

14. **bracteàta**, S. Wats. Rudimentary lvs. brown, very rigid; produced lvs. 1 to few, much exceeding the stem, 1–2 ft. long, one side green, the other glaucous, edge revolute: stem 1-headed, angled, 2–3 in. to 1 ft. long, sheathed with bracts 2–4 in. long: tube short, funnelform: outer segments 2–3 in.; blade ovate, as long as the claw, pale yellow, veined with bluish purple; inner segments shorter, erect, yellow; style branches long, narrow. June. Discovered in 1884 by Thomas Howell, in Ore. G.F. 1:43.—Int. 1888.

15. **Missouriénsis**, Nutt. (*I. Tolmieàna*, Herb.) Lvs. pale green, finely ribbed, 1–1½ ft. long: stem 1–2 ft. long, usually exceeding the lvs., bearing a single large leaf low down: pedicel long: tube very short: limb bright lilac: outer segments obovate, 1 in. broad, yellow near the claw; inner segments oblong, straight, erect. Wet soil. S. Dak. and Mont. to Ariz. Gn. 50:1082.—Not common in cult. Flowers early.

16. **Douglasiàna**, Herb. Rhizome stout, short, creeping: lvs. about 6 in a tuft, broadest in the middle, strongly ribbed, 1–2 ft. long: stem 1–2 ft. high, usually simple, with one long bract leaf: tube ½–¾ in. long: fls. 3–4 in. in diameter; outer segments obovate-spatulate, spreading and recurved, pale lilac, with a white disk and purple veins; inner segments shorter, erect, lanceolate, acuminate, pale lilac, not veined. Calif. B.M. 6083. Gn. 50:1086.

17. **fùlva**, Ker. (*I. cùprea*, Pursh). Lvs. thin, bright green, 1½–2 ft. long, not exceeding the stem: stem 2–3 ft. high, forked low down; lower stem-lvs. 1 ft. long: pedicel produced: tube greenish yellow, 1 in. long: limb loosely expanded, bright reddish brown or copper-colored, variegated with blue and green; outer segments obovate-cuneate, emarginate; inner segments smaller, spreading. Late June. In swamps, Ill. to Ga., La. and Tex. Introduced into England 1811 by Lyon. B.M. 1496. Gn. 53:1175. Mn. 5:61.

18. **Pseudácorus**, Linn. Lvs. 1½–3 ft. long, equaling the stem: stem stout, terete, 2–3 ft., bearing several long lvs. and several clusters of fls.: limb bright yellow; outer segments broadly obovate, 2–2½ in. long, yellow, with a bright spot and radiating brown veins on the claw; inner segments scarcely longer than the claw of the outer, oblong. May, June. Europe, Syria and the Barbary states; naturalized in N. Y., Mass. and N. J.—The plants form fine, large clumps, bearing numerous flowering stalks. Var. **variegàta**, Hort. Lvs. striped with creamy white. Var. **pállida**, Hort. Fls. pale sulfur-yellow.

19. **versícolor**, Linn. Lvs. slightly glaucous, 1½–2 ft. long: stem forked low down and often branched above, 2–3-headed: tube very short: limb violet-blue; outer segments spatulate, 2–3 in. long, variegated with yellow on the claw and veined with purple; inner segments oblanceolate, much smaller. British N. A. and northern U. S. Int. into Eng. 1732. B.M. 21. G.W.F. 5. D. 89.

20. **hexágona**, Walt. Lvs. 2–3 ft., long: stem usually simple, 3 ft. long, 2–3-headed, with several large lvs., the upper ones exceeding the fls.: spathe valves sometimes leaf-like: tube 1 in. long, green, dilated upward: limb bright lilac; outer segments 3 in. long; blade obovate, with a bright yellow keel on the claw; claw downy; inner segments shorter, erect; style branches very concave, green, with a central lilac band. Ky. to Tex. and Fla. B.M. 6787.

21. **Caroliniàna**, S. Wats. Lvs. 2–3 ft. long, bright green: stem stout, simple or branched: tube ½ in. long: limb lilac, variegated with purple and brown; outer segments broadly spatulate, 2½–3 in. long, with narrow claws; inner segments narrower, nearly erect. Differs from *I. versicolor* by its green lvs. Discovered by W. A. Manda in N. Car. G.F. 6:335.

22. **setòsa**, Pallas. Lvs. thin, green, 1–1½ ft. long: stem deeply forked, much exceeding the lvs.: tube ¼ in. long: limb bright lilac; outer segments 2–2½ in. long; blade 1 in. broad, suddenly narrowed at the claw, copiously veined; inner segments very small, ½ in., cuneate, large-cuspidate; style branches large, crested. E. Siberia, Japan, and northwestern Amer. B.M. 2326. Gt. 322.

23. **Gueldenstædtiàna**, Lepech. Lvs. pale green, 1–1½ ft. long: stem stout, terete, 1½–2 ft. long, often bearing 1–2 spicate clusters below the end one: limb pale yellow; outer segments with an orbicular blade ½–¾ in. broad, shorter than the claw, which has a bright yellow keel and faint lilac veins; inner segments shorter, erect. Asia.—Var. **Sogdiàna**, Baker. A variety with gray-lilac flowers.

24. **aùrea**, Lindl. Lvs. scarcely glaucous, 1½–2 ft. long: stem 3–3½ ft. long, stout, terete, with 1–2 sessile clusters below the end one: spathes 2–3-fld.: pedicel long: limb bright yellow; outer segments with an oblong blade 1 in. broad, as long as the claw; inner segments less than ½ in. broad. July. West Himalayas. B.R. 33:59. Gn. 31:579.—Int. by Dr. Royle. This species has brighter yellow fls. than the others of this group (18–21).

25. **Monnièri**, DC. Lvs. slightly glaucous, 2–3 ft. long: stem stout, terete, 3–4 ft. long, with several sessile clusters of fls.: limb 2½–3½ in. long, lemon-yellow, without veins; blade of outer segments orbicular, 1–1½ in. long, equaling the claw; inner segments oblong-unguiculate, 1 in. broad. Rhodes and Crete. Discovered and int. by Sieber, 1821. Not showy except in masses. This and *I. orientalis* are perhaps varieties of *I. spuria*.

1173. Habit sketch of Iris orientalis (×1-20). No. 26.

26. **orientàlis**, Miller (*I. ochroleùca*, Linn. *I. gigantèa*, Carr.). Fig. 1173. Plants growing in strong clumps: lvs. 2–3 ft. long, slightly glaucous: stem 3–4 ft., stout, terete, with 2–3 spicate clusters of fls.: outer segments obovate, 1 in. broad, as long as the claw, yellow, paler or white toward the margin; inner segments oblong, 1 in. broad, lemon-yellow to whitish. Asia Minor and Syria. B.M. 61. Gn. 20:301; 38:779; 46, p. 362 and 50, p. 186. R.H. 1875, p. 357.—One of the largest of the Irises. Grows in almost any situation. White forms of this plant are in cultivation.

27. **fœtidíssima**, Linn. GLADWIN. Lvs. 1–1½ ft. long: stem compressed, 2–3 ft. long, 2–3-headed: tube ½ in. long: limb bright lilac; outer segments 1½–2 in. long, with a suborbicular blade equaling the claw; inner segments shorter, oblanceolate. Central and S. Eu., Eng., Afghanistan and Algeria. Gn. 47, p. 30.—This plant is very distinct, and is easily recognized by the odor of the broken lvs. The capsules remain on the plants in winter, bursting open and displaying rows of orange-red berries. The fls. are rather inconspicuous. There is a whitish variety with brown veins, and a variety with white-striped lvs.

28. **lævigàta**, Fisch. & Mey. (*I. Kæmpferi*, Sieb.). JAPANESE IRIS. Fig. 1174. Lvs. thin, ensiform, 1–1½ ft. long: stem much overtopping the lvs., obscurely angled, 1–3-headed: pedicel ½–2 in. long: tube short: limb blue, violet, etc., sometimes white, spreading, 3–5 in. across; outer segments broadly ovate-oblong, obtuse, with a yellow spot on the claw; claw short, distinct; inner segments oblanceolate, erect, conniving or spreading: style branches with bifid, incurved lobes. E. Siberia and Japan. Int. by Von Siebold, and flowered at Ghent in 1857. B.M. 6132. I.H. 5:157. F.S. 20:2073–74; 23:2431–36. Gt. 442. Gn. 9:21; 16:195; 21:341; 55, p. 105. R.H. 1890, p. 188. G.C. III. 13:165, 169; 14:501. A.G. 19:596. Gng. 1:256; 5:163; 6:339; 7:145. J.H. III. 28:205. F.E. 10:777. F.M. 1874:137; 1880:403.

29. **Trojàna**, Kerner. Lvs. very acute, glaucescent: stem over 3 ft. high, much branched and overtopping the lvs.: pedicel none: fls. bright violet-purple; outer segments obovate; blade longer than the claw; claw white, bordered with yellow and veined with brown-purple; inner segments elliptic, suddenly narrowed to a claw: style crests broad, denticulate. Troad, Asia Minor.

30. **spùria**, Linn. Lvs. firm, linear, glaucescent, 1 ft. long: stem overtopping the lvs., bearing 1–3 spicate heads: pedicel shorter than the spathe: tube ½–¾ in. long: limb bright lilac; outer segments with an orbicular, spreading blade ½ in. broad and half as long as the claw; claws broad, concave, lilac, with a yellow

keel and purple veins; inner segments shorter, straight, oblanceolate: style crests small. Central and S. Europe. B.M. 58.

Var. **nòtha**, Bieb. (*I. halophýlla*, Ker.). More robust: lvs. 1 in. broad: spathes larger: stem 2–3 ft. high. Caucasus to Kashmir. Int. 1780 by Peter Pallas. B.M. 875. —Hardy.

SUBGENUS PARDANTHOPSIS.

31. **vérna**, Linn. Dwarf, 6 in. high: rhizome wide-creeping: sheaths not splitting into fibers: lvs. linear, slightly glaucous, 3–8 in. long: stem scarcely any, 1-headed: tube slender, 1½ in. long: limb deep violet; outer segments 1½ in. long, obovate, narrowed into a slender yellow, slightly pubescent claw; inner segments erect, smaller, violet. Shade, Ohio, Ky., Va. and south. L.B.C. 19:1855.

SUBGENUS EVANSIA.

A. *Stem very short*........................32. **cristata**
AA. *Stem equaling or exceeding the lvs.*
  B. *Pedicels much shorter than the spathe*............................33. **tectorum**
  BB. *Pedicels as long as the spathe, and articulate at the apex*..............34. **Milesii**
35. **Japonica**

32. **cristàta**, Ait. Plant dwarf: rhizome slender, creeping: lvs. ensiform, thin, 4–8 in. long, green: stem 1–3 in. high, flattened, 1-headed, bearing 2–3 lvs.: tube slender, 1½–2 in. long: limb blue; outer segments obovate, 1–1½ in. long, crested; inner segments shorter, naked. Apr., May. Mts. Ky., Va. and Carolinas. B.M. 412. Gn. 45, p. 127. L.B.C. 14:1366.

33. **tectòrum**, Maxim. Fig. 1175. Lvs. 1 ft. long, ensiform, strongly ribbed: stem 1½ ft., subterete; heads on long peduncles: tube 1 in. long: limb bright lilac; outer segments 2 in. long, obovate; claw half as long as the blade, streaked with violet, with a wavy edge and a large, laciniate, white and lilac crest running up the claw and half up the blade; inner segments spreading, nearly as large, plain lilac, short-clawed. Sent to Eu. in 1872 by Dr. Hance. Cult. in China and Japan. B.M. 6118. F.S. 22:2282. Gt. 716. Gn. 50:1086.

1174. Japanese Iris (×½).
Iris lævigata, better known as *I. Kæmpferi*. No. 28.

34. **Milesii**, Baker. Lvs. 7–8 on the stem, 2–3 ft. long and 2–3 in. broad: stem 2–3 ft. high, branched, bearing 4–5 heads: fls. bright lilac, lasting only a day; outer segments oblong-cuneate, claret-purple, whitish in the center, spotted and veined with lilac, furnished with a deeply laciniated yellow crest; inner segments oblong, spreading; style crests deeply toothed. Near *I. tectorum*, but inferior. Himalayas. B.M. 6889.

35. **Japónica**, Thunb. (*I. Chinénsis*, Curt. *I. fimbriàta*, Vent.). Fig. 1176. Lvs. ensiform, 1–1½ ft. long: stem slender, as long as the lvs., with a raceme of lilac fls.: tube ¾ in. long: outer segments 1–1½ in. long, with crimped margins, yellow on the claw, crested; inner segments smaller. Winter. Japan and China. B. M. 373. Gt. 511. Gn. 28:503. J. H. III. 31:185. A. G. 12:704. F. R. 2:149.—An evergreen greenhouse plant.

1175. Iris tectorum (×¼). No. 33.

SUBGENUS PSEUDEVANSIA.

36. **Álberti**, Regel. Lvs. ensiform, glaucous, 1½–2 ft. long: stem exceeding the lvs., bearing 5–6 heads in a loose panicle; outer segments obovate cuneate, 2 in. long, bright lilac, with a rudimentary crest and a dense beard of white, yellow-tipped hairs, veined; inner segments as long and broader than the outer, with convolute claws, lilac. Discovered in Turkestan by Dr. Albert Regel. Gt. 999. B.M. 7020.

SUBGENERA POGONIRIS AND REGELIA.

A. *Dwarf: lvs. generally less than 9 in. long.*
  B. *Pedicel obsolete, or very short.*
    C. *Perianth tube 2 in. or more in length*..................37. **pumila**
38. **pseudo-pumila**
    CC. *Perianth tube 1 in. or less in length.*
      D. *Stem 6 in. or more in length.*
        E. *Fls. blue, purple, violet, etc.*
          F. *Spathe valves green or nearly so.*
            G. *Lvs. linear*.....39. **gracilis**
            GG. *Lvs. ensiform*...40. **Balkana**
41. **biflora**
          F. *Spathe valves entirely scariose*...42. **Cengialti**
        EE. *Fls. yellow*..........43. **virescens**
44. **lutescens**
      DD. *Stem 2 in. or less in length.*
        E. *Fls. blue*.............41. **biflora**
        EE. *Fls. yellow*..........45. **Chamæiris**
  BB. *Pedicel as long as the ovary.*
    C. *Sheaths not splitting into fibers*...................46. **arenaria**
    CC. *Sheaths splitting into fibers*.47. **flavissima**
AA. *Tall: lvs. generally more than 1 ft. long.*
  B. *Stem 2–6-headed.*
    C. *Fls. yellow*................48. **variegata**
49. **flavescens**

CC. *Fls. blue, violet, etc., or white.*
  D. *Stem short, scarcely overtopping the lvs*........50. **aphylla**
  51. **lurida**
  52. **Benacensis**
  53. **Kochii**
  DD. *Stem tall, much overtopping the lvs.*
    E. *Spathe valves scarious*................54. **Florentina**
    55. **pallida**
    56. **plicata**
    57. **Swertii**
    EE. *Spathe valves green, or scarious only on the upper portion.*
      F. *Spathe valves tinged with purple*..............58. **neglecta**
      59. **hybrida**
      60. **Germanica**
      FF. *Spathe valves not tinged with purple*..............61. **squalens**
      62. **sambucina**
      63. **Biliotti**
      64. **Cypriana**
BB. *Stem 1-headed.*
  C. *Spathe valves entirely scarious at the flowering time.*65. **atroviolacea**
  CC. *Spathe valves green.*
    D. *Lvs. thin, linear*........66. **Suwarowi**
    DD. *Lvs. ensiform*...........67. **Leichtlini**
    68. **Korolkowi**

37. **pùmila,** Linn. (*I. gràcilis*, E. Berg.). Fig. 1177. Lvs. linear, 2–4 in. long: stem none or very short, 1-headed: spathe valves scariose at the tip: fls. fugitive, yellow, or bright or dark lilac: limb 2 in. long. A dwarf, hardy plant, spreading rapidly in borders. B.M. 9. L. B.C. 16:1574.—Var. **alba,** Hort., pure white. Var. **atroviolàcea,** Hort., velvet-purple. Var. **azùrea,** Hort., azure-blue.

38. **pseudo-pùmila,** Tineo (*I. Panormitàna*, Tod.). Lvs. ensiform, glaucescent, 6–9 in. long, narrowed suddenly to an oblique tip, 1-headed, 6–8 in. long, 1-fld.: tube 2–2½ in. long: spathe valves green: fls. varying from yellow to bright lilac; outer segments oblong unguiculate, 2–2½ in. long; inner segments rather broader. Mts., Sicily.

39. **grácilis,** Maxim. Tufted lvs. grass-like, shorter than the stem: stem 1 ft. long, 1-headed: fls. pale lilac; outer segments obovate-oblong, with a yellow beard; inner segments oblong-emarginate, with a short claw. Western China.

40. **Balkàna,** Janka. Rhizome stout: tufts crowded: lvs. ensiform, glaucescent, 3–4 in. long: stem 6–9 in. long, 1-headed: spathes 1–2-fld.: fls. dark claret-lilac; outer segments obovate-cuneate, 2–3 in. long; beard dense, white, tipped with lilac; inner segments erect, oblong. Early May. Balkans.

41. **biflòra,** Linn. (*I. fràgrans*, Salisb. *I. nudicaùlis*, Hook.). Lvs. 6–9 in. long: stem 2–10 in. long, compressed: fls. bright violet-purple; outer segments obovate-cuneate, 2–2½ in. long, with dark veins and a beard of long, yellow hairs. Portugal and N. Morocco. B.M. 5806.

42. **Cengiálti,** Ambrosi. Resembles *I. pallida*, of which it is probably merely a dwarf variety: lvs. 6 in. long: stem about as long as the lvs.: fls. bright lilac; outer segments with a white beard. May, June. Lombardy and S. Tyrol.—Often spelled *I. Ciengialli*.

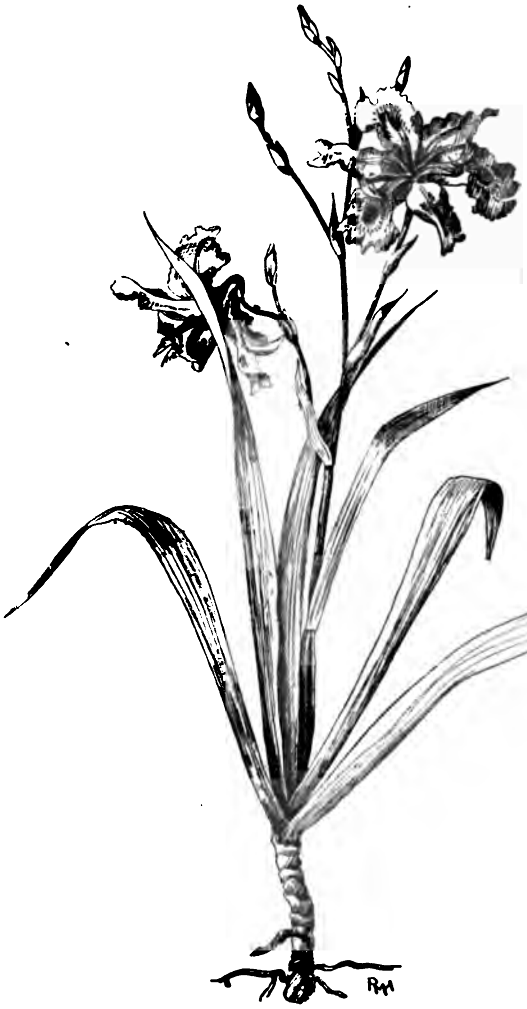
43. **virèscens,** DC. Lvs. 8–9 in. long: stem 9–12 in. long, bearing 2–3 reduced lvs.: outer segments obovate-cuneate, 2–2½ in. long, 1 in. broad, greenish yellow, veined at the claw with purple; inner segments obovate, dull yellow. April. Valais.

44. **lutéscens,** Lam. Lvs. 6–9 in. long: stem equaling the lvs.: fls. pale yellow; outer segments obovate-cuneate, 2–2½ in. long, pale yellow, streaked with pale brown, undulate; inner segments broader, suddenly narrowed to a claw, which is streaked with purple, crenulate. S. France. B.M. 2861.—Var. **Statéllæ,** Tod. Spathe valves shorter, less pointed, and more scariose: segments broader. Sicily. B.M. 6894.

45. **Chamæiris,** Bertol. (*I. Olbiénsis*, Henon). Lvs. 3–4 in. long, ½ in. broad: stem very short: fls. bright yellow; outer segments obovate-cuneate, tinged and veined with brown; inner segments oblong. May. Italy, France.—Var. **Itálica,** Parl. Fls. dark violet.

46. **arenària,** Waldst. Lvs. few in a tuft, linear, 3–4 in. long: stem short: limb bright yellow: outer segments oblong-cuneate, 1¼ in. long, ½ in. broad; inner segments smaller: very distinct. Rare in cult., but good for dry soils.—Hardy. Var. **minor,** Hort. Smaller. B.R. 7:549.

47. **flavissima,** Pallas. Lvs. thin, linear, 4–8 in. long: stem 1–6 in. long: limb bright yellow: outer segments 1–1½ in. long, ¾ in. broad; inner segments oblong, narrower.—Var. **Bloudòvii,** Led. (*I. Bloudòvii*, Hort. More robust, with broader lvs., a larger stem and larger fls. Siberia and Mongolia.



1176. Iris Japonica. A crested flower (× ⅛). No. 35.

48. **variegàta,** Linn. Lvs. 1–1½ ft. long: stem equaling the lvs.: outer segments oblong-cuneate, claret-brown toward the tip, much veined with brown on a yellow ground; beard bright yellow; inner segments erect, oblong, bright yellow, veined. Austria, Turkey and S.

Russia. Long in cult. B.M. 16. Gn. 14:135; 52 1143 (var. *aurea*). Var. **honorábilis,** Hort. Yellow, shaded with brown.

49. **flavéscens,** DC. Lvs. 12–15 in. long: stem 2–3 ft. high: fls. bright lemon-yellow; outer segments obovate-cuneate, 2½ in. long; beard deep yellow; inner segments obovate, pale yellow. Bosnia to Caucasus and Armenia. B.R. 31:35 (as *I. imbricata*).

50. **aphýlla,** Linn. (*I. furcàta*, Bieb. *I. Bohèmica*, F. W. Schmidt. *I. Hungàrica*, Waldst. *I. falcàta*, Tausch.). Lvs. glaucescent, 6–12 in. long: stem equaling the lvs., sometimes forked low down, leafless: spathe valves greenish: fls. dark lilac; outer segments obovate-cuneate, 2–2½ in. long; beard white; inner segments broader, obovate. E. Eu. B.M. 2361. B.R. 10:801. L.B.C. 20:1970.—Nos. 50 to 53 cannot be easily separated from each other by the material available. They are distinguished by slight differences in the lvs., spathe valves, beard, and form of the segments, as described in the text.

51. **lùrida,** Ait. Lvs. 1 ft. long, slightly glaucous: stem not much overtopping the lvs., 3–4-headed: spathe valves green, very ventricose: outer segments obovate-cuneate, reflexed from half-way down, dead purple at the top, veined with dull purple on a yellowish ground below; beard yellow; inner segments broader, dull purple. Southeastern Eu. B.M. 986.

52. **Benacénsis,** Kerner. Lvs. 1 ft. long: stem about as long as the lvs., 3-headed: spathe valves lanceolate, herbaceous, tinged with purple, scarious at the tip: outer segments obovate, dark violet, veined with brown-violet; beard yellowish white; inner segments oblong, clawed, bright violet. Limestone rocks, S. Tyrol.

53. **Kòchii,** Kerner. Lvs. 12–15 in. long, glaucescent: stem as long as the lvs., 3–4-headed: spathe valves lanceolate, the outer herbaceous: outer segments obovate, dark violet; claw veined with brown; beard yellow; inner segments obovate, clawed, dark violet. Istria, near Trieste and Rovigno.

1177. Iris pumila (×½).
One of the best dwarf species.

54. **Florentina,** Linn. Rhizome fragrant when dried (orris-root): lvs. 1–1½ ft. long: stem exceeding the lvs.: fls. white; outer segments 3½ in. long, tinged with lavender; claw yellowish veined with purple; inner segments as large, white. Cent. and S. Eu. B.M. 671. Gn. 16:190 and 51, p. 295.—Flowers early, with *I. Germanica*. Hardy. Var. **álbicans,** Lange. Pure white. Spain to Cyprus. Var. **álba,** Hort. Pure white.

55. **pállida,** Lam. (*I. Junònia*, Schott & Klotschy. *I. Asiática*, Stapf. *I. sícula*, Tod.). Lvs. 1½ ft. long: stem much exceeding the lvs., 2–3 ft. high: fls. fragrant, violet, rarely white; outer segments obovate-cuneate, 3½ in. long; inner segments orbicular. Differs from *I. Germanica* by its scented fls., which appear a month later. B.M. 685. Gn. 14:85; 33:631; 50, p. 119. G.M. 38:441.—Var. **speciòsa,** Hort. Tall, with large, light blue flowers.

56. **plicàta,** Lam. (*I. aphýlla*, var. *plicàta*, Ker.). Rhizome, stem and lvs. as in *I. pallida:* outer segments obovate, pure white in the center, conspicuously veined with lilac towards the margin and on the claw; inner segments very plicate, white tinged with lilac on the margin. B.M. 870.—Known only in cult. Probably derived from *I. pallida*.

57. **Swértii,** Lam. (*I. aphýlla*, var. *Swértii*, Ker.). Much dwarfer than *I. Florentina* and *I. pallida*. Stem 1–1½ ft. long: spathe valves flushed with violet: outer segments 2–2½ in. long, obovate-cuneate, white, faintly veined and flushed with purple on the margin; inner segments as large, much crisped, pure white, except the purple keel and margin. Fls. May and June, long before *I. pallida*.—Fragrant. Known only in cult.

The following seven species (58–64) are closely related, the distinctions between them being mainly those of degree. Some of them are known only in cultivation, and are no doubt derived forms; all are connected by numerous intermediate garden forms:

58. **negléota,** Horn. Lvs. slightly glaucous, 12–15 in. long, ensiform, purple at the base: stem taller, 1½–2 ft., many-fld.: spathe valves green below at the flowering time, much tinged with purple: outer segments obovate-cuneate, very obtuse, 2 in. long, violet-blue on the margin, whitish veined with blue in the center; beard yellow; inner segments erect or connivent, oblong, as large as the outer, pale lilac. June. B.M. 2435. —Known only in cult.

59. **hýbrida,** Retz. (*I. amœna*, DC.). Differs from *I. neglecta* by its longer spathe valves, and its pure white or faintly lilac-tinted outer segments and style branches. June.—Known only in cult.

60. **Germánica,** Linn. Fig. 1178. Lvs. 1–1½ ft. long: stem 2–3 ft. high: spathe valves tinged with purple: outer segments obovate-cuneate, 2–3 in. long; beard yellow; inner segments as large, obovate, connivent. Central and S. Eu. Early May, June. B.M. 670. B.R. 10:818. I.H. 40:182 (var. Gypsea, pure white). Gn. 48:1033 (dark purple var.).—Var. **reticulàta subérba,** Hort. Outer segments purple, veined; inner segments lavender.

61. **squàlens,** Linn. Lvs. glaucous, 1–1½ ft. long: stem 2–3 ft. high: spathe valves subscarious: outer segments obovate-cuneate, upper part plain lilac-purple; claw yellow, veined with lilac; beard yellow; inner segments as large, obovate, dull lilac and yellow, or brownish and yellow. Central Eu. to Caucasus. B.M. 787.—Many of the German Irises of cultivators belong to this form. Var. **Jacquesiàna,** Hort. Outer segments dark red-violet, yellow at base; inner segments tawny yellow. Late. One of the best.

62. **sambucina,** Linn. Differs from *I. squalens* by its less robust habit, narrower segments and elder-like odor. The outer segments are colored and veined with claret, not lilac, purple; inner segments emarginate. Late May. Central Eu. B.M. 187.—Tall and handsome.

63. **Bilióttii,** Fost. Lvs. darker green, more distinctly striated, and more rigid than in *I. Germanica:* stem several-headed, 2½–3 ft. long: spathe valves ventricose: outer segments obovate cuneate, reddish purple, with many dark veins; beard white, tipped with yellow; inner segments orbicular unguiculate, 2 in. broad, bright blue-purple. Late June. Trebizond.—Very near *I. Germanica*.

64. **Cypriàna,** Foster & Baker. Plants tall, the branching stem being 3 ft. high, bearing many fls. 6–7 in. in diameter: outer segments obovate cuneate, reddish lilac, with thin, darker veins; claw whitish, with greenish brown veins; inner segments oblong-unguiculate, lilac, spotted with reddish brown on the claw. June, July. Cyprus.—Very near *I. pallida*, from which it differs only by the longer navicular spathe valves, which are not entirely scariose at the flowering time, and the more obovate segments.

65. **atroviolàcea,** Lange. Lvs. very glaucous, 1 ft. long: stem equaling the lvs.: spathe entirely scariose: fls. dark violet, very fragrant; outer segments obovate-

cuneate, 3 in. long; beard white, tipped with yellow; inner segments as long, 2 in. broad, orbicular. Late May.—Known only in cult. Probably a hybrid between *I. Chamæiris* and *I. pallida.*

66. **Suwaròwi,** Regel (*I. lineàta,* Foster). Lvs. thin, linear, 1 ft. long, pale green : stem 1 ft. high, bearing 2–3 reduced lvs. and a single head of fls.: outer segments oblong-cuneate, ⅜ in. broad, 2 in. long, closely veined with oblique lines of claret-purple on a greenish yellow ground; beard blue; inner segments oblong, with a long claw, often faintly bearded, veined and tinted on the margins with claret-purple. B.M. 7029.

67. **Leichtlini,** Regel (*I. vàga,* Foster). Rhizome slender, wide-creeping : lvs. in tufts, not contiguous, ensiform, 1–1½ ft. long, scarcely glaucous: stem 1½ ft. long, 1-headed, bearing 2–3 fls. and 2 reduced lvs.: outer segments 2–2½ in. long, oblong-cuneate, bright lilac, with a whitish beard; inner segments oblong, as broad as the outer, claw also bearded. Turkestan. Gn. 52:1136. —Var. *vàga,* Hort., has larger flowers.

68. **Korolkòwi,** Regel. Rhizome short-creeping: lvs. glaucous, 1 ft. long: stem 1 ft. long: limb 2½–3 in. long, milk-white, veined with red-brown in the type: outer segments oblong, 1 in. broad, with a brown beard and a brown patch in the throat; inner segments as large, erect. May. Turkestan. B.M. 7025. Gn. 28:517. G.C. III. 4:37.—Very hardy. One of the earliest. Variously colored lilac, etc., in cult. Var. **cóncolor,** Hort. Purplish lilac, veined darker. Var. **Leichtliniàna,** Hort. Creamy white, with brownish veins. Var. **violàcea,** Hort. Violet, with dark veins.

SUBGENUS ONCOCYCLUS.

A. *Outer segments ligulate, much reduced* ....69. **paradoxa**
AA. *Outer segments not much smaller than the inner.*
  B. *Lvs. pale green.*
    C. *Lvs. ensiform*..........75. **atrofusca**
    CC. *Lvs. linear*..........70. **Sarii**
      71. **Mariæ**
  BB. *Lvs. glaucous.*
    C. *Lvs. ensiform*..........72. **Bismarckiana**
      73. **Lortetii**
      74. **atropurpurea**
    CC. *Lvs. linear.*
      D. *Stem very short or none*..76. **Iberica**
      DD. *Stem over 6 in. long*......77. **Susiana**
        78. **Gatesii**
        79. **Nazarena**
        80. **lupina**

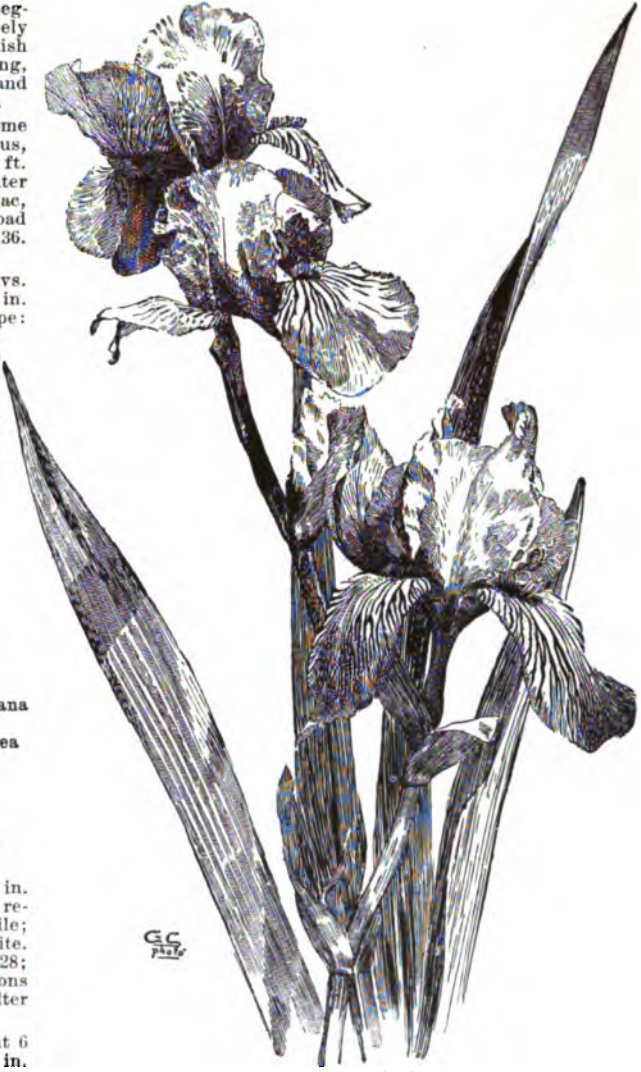
69. **paradóxa,** Stev. Plants dwarf: lvs. linear, 3–6 in. long : stem 2–6 in. high: fl. large; outer segments reduced to a mere claw, dark, covered with a dense pile; inner segments 2 in. long, orbicular, lilac to white. Mts., Georgia and N. Persia. B.M. 7081. Gn. 32:628; 46, p. 173. Gt. 386.—A flower with singular combinations of color. Grows in dry situations, but requires shelter in winter. Long cult., but not common.

70. **Sàrii,** Schott. Rhizome short, stout: lvs. about 6 in. long, finally 1 ft., linear-complicate : stem 3–6 in. long, with 2 reduced lanceolate lvs.: pedicel very short: tube 1 in. long: fls. bright lilac, large as in *I. Susiana:* outer segments obovate-cuneate, 1½–2 in. broad, reflexed from half way down ; inner segments oblong, with a short claw. Very near *I. Iberica,* from which it differs chiefly by its bright lilac fls. Asia Minor. Var. **lùrida,** Boiss. Outer segments with many brown-black spots and lines on a pale brownish ground. B.M. 6960.

71. **Màriæ,** Barbey (*I. Hélenæ,* Barbey). Lvs. very falcate, 3–4 in. long: stem 3–6 in. long, with 2–4 short lvs.: limb pale lilac, with fine red-brown veins: outer segments orbicular, 2½ in. long, with a dark purple patch at the throat; inner segments larger, more rounded. Desert between Egypt and Palestine. Discovered 1880. Gt. 42, p. 488; Supp. Pl. J.H. III. 28:302. G.M. 37:215.

72. **Bismarckiàna,** Hort. Damman. Habit of *I. Susiana,* and fls. as large: lvs. 8 in. long: stem 1 ft. high: outer segments orbicular, ash-gray, with darker veins and a dark spot at the base; inner segments sky-blue, with blackish veins. Lebanon. G.M. 40:250.

73. **Lortétii,** Barbey. Lvs. less than 1 ft. long: stem short: limb 4 in. long: outer segments obovate, 3 in. broad, whitish, finely veined and spotted with red-brown, with a dark spot at the throat: inner segments orbicular, connivent, pale gray, with red-brown veins. —Quite hardy N. B.M. 7251. Gn. 43:897; 48, p. 337. Gt. 42, p. 490. G.C. III. 12:153. G.M. 36:386; 40:250.



1178. Iris Germanica (× ⅓).
Typical of many species in which the beard is confined to the midrib.

74. **atropurpùrea,** Baker. Lvs. 6 in. long: stem 4–5 in.: outer segments oblong, 2 in. long, purplish black, without veins, with a yellow patch on the throat and a beard of yellow, black-tipped hairs; inner segments larger, of the same color, with discernable veins: style crests small. Easily distinguished by its rather small, uniformly colored flowers. Gt. 42, p. 489. Pl. Supp.

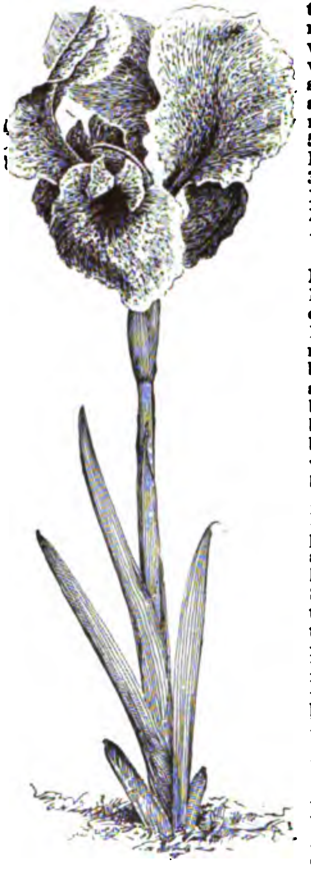
75. Var. **atrofùsca,** Baker (*I. atrofúsca,* Baker). Lvs. pale green, 1 ft. long: stem 1 ft. long, hidden by the sheathing inner lvs.: limb dark purple-brown; outer segments obovate, 3 in. long, with a dark spot on the

throat; inner segments larger and broader: style branches very convex; crests large. B.M. 7379. Gn. 48, p. 8; 50:1089 and p. 333.

76. **Ibèrica,** Hoffm. Dwarf, with a large flower: lvs. 3–6 in. long, narrow, very falcate: stem 3–4 in. long: outer segments rounded-obovate, 2 in. broad, pale brown, closely veined and blotched with purple-brown and with a shining dark patch on the throat; inner segments connivent, pure white, faintly veined, with a few wine-red spots at base. Caucasus and mountains of Armenia and Persia. B.M. 5847. Gt. 386 and 723. F.S. 19:1963. R.H. 1873: 370. Gn. 10:49. I.H. 19: 106. G.C. II. 11:693. F. 1873:25. F.M. 1875: 168. —Hardy.

77. **Susiàna,** Linn. MOURNING IRIS. Fig. 1179. Lvs. very glaucous, 6–9 in. long, nearly 1 in. broad: outer segments obovate, 3 in. long, brownish purple, veined and spotted with black-brown, with a brown beard; inner segments brownish white, spotted with violet-brown and black. Asia Minor and Persia. B.M. 91. F.S. 11:1087, 1088. R.H. 1859, p. 322, 323. Gn. 32, p. 193 and 39: 800.—The best known of this group. Said to have been introduced from Constantinople in 1753. Name from a city in Persia. Not entirely hardy North, but a good pot-plant. Var. **màjor,** Hort. Bluish, tinted brown.

78. **Gàtesii,** Foster. Habit and foliage of *I. Susiana:* outer segments orbicular, 3 in. broad, cream-white, sometimes sky-blue, covered with a network of fine veins, giving them a light gray tint; inner segments larger, pale purple or yellow. Dry regions, Armenia. Gn. 43: 897, and 52, pp. 88 and 279. G.C. III. 8:17. A.G. 13:60.—The largest-fld. of its subgenus. Fls. about twice as large as in *I. Susiana.* Quite hardy.



1179. Type of Oncocyclus Iris—Iris Susiana (× ⅛).

Type of diffusely bearded flower.

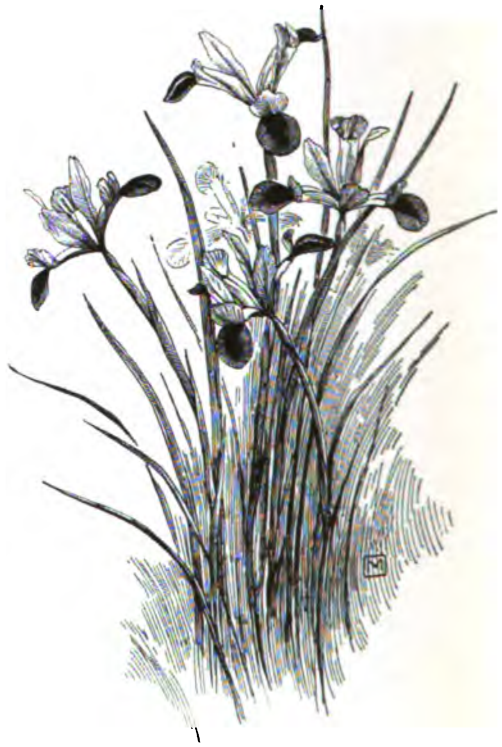
79. **Nazarèna,** Hort. (*I. Sàrii,* var. *Nazarèna,* Fost.). Foliage and stem of *I. Susiana,* and fls. as large: outer segments obovate, straw-colored, netted with red and brown veins and blotched with a patch of black-crimson near the claw; beard dark purple, with a bare streak running down the claw; inner segments cream-white, with thin blue veins. Palestine.—Foster described this plant without definitely determining its systematic position. It is related to *I. Sarii* and to *I. Bismarckiana,* and differs from the other members of this section by its long, creeping, stoloniferous rhizome. See Gn. 43, p. 133. I.H. 42, p. 78. Gt. 42, p. 487 and supp. pl.

80. **lupina,** Foster. Lvs. 1 ft. long: stem 6 in. high, with 2 lvs. and 1 fl.: outer segments obovate-cuneate, yellowish green, with red-brown veins and a velvety dark brown patch on the throat; claw with a yellowish beard; inner segments orbicular, with a short claw, colored like the outer; style crests large, toothed. Turkish Armenia, where it is called "Wolf's Ear," hence the specific name. Gn. 43:897 and 54, p. 59.

SUBGENUS XIPHION.

A. *Stem 1 ft. or more in length.*
  B. *Tube obsolete.*
    C. *Lvs. subterete*............81. **Xiphium**
    CC. *Lvs. linear complicate*....82. **xiphioides**
  BB. *Tube more or less developed.*
    C. *Lvs. linear complicate*....83. **Tingitana**
    CC. *Lvs. slender, terete or subterete.*
      D. *Pedicel 1½ in. long*...84. **filifolia**
      DD. *Pedicel short*..........85. **juncea**
      86. **Boissieri**
AA. *Stem very short or none.*
  B. *Lvs. acutely quadrangular, very short at the flowering time*......................87. **reticulata**
  BB. *Lvs. acutely quadrangular, much overtopping the fl.*...88. **Histrio**
    89. **Vartani**
  BBB. *Lvs. terete or linear subterete.*
    C. *Bulb tunics composed of parallel fibers*..........90. **Bakeriana**
    CC. *Bulb tunics reticulated*...91. **Kolpakowskiana**

81. **Xiphium,** Linn. (*I. Hispánica,* Hort. *I. spectábilis,* Spach). SPANISH IRIS. Fig. 1180. Lvs. about 1 ft. long: stem 1–2 ft. high: pedicel long: tube obsolete: outer segments 2–2½ in. long, violet-purple, yellow in the center; inner segments as long, but narrower. Late June. Spain and N. Afr. B.M. 686. Gn. 20:308 and 30, p. 385.—Long cult. and well known. Hardy in N. J. in protected situations. Var. **Lusitánica,** Ker. (*I. Lusitánica,* Hort.). Fls. yellow. B.M. 679.



1180. Iris Xiphium (× ¼). Type of bulbous Iris.

82. **xiphioides,** Ehrh. (*I. Ánglica,* Hort.). ENGLISH IRIS. Lvs. about 1 ft.: stem 1–2 ft.: fls. dark violet-purple in the typical form: outer segments orbicular, yellow in the center; inner segments shorter, oblong. French and Spanish Pyrenees. B.M. 687. Gn. 30, p. 384; 31:586.

83. **Tingitàna,** Boiss. & Reut. Stem stout, 1–2-headed, about 2 ft. high, hidden by the sheathing bases of the stout, falcate lvs., of which there are 6–7 on the stem, the lower about 1 ft. long: fls. 2–3 in a cluster; outer segments 3 in. long, with an obovate, reflexed blade, pale lilac, yellow in the center, and with a bright yellow keel down the claw; inner segments shorter, oblanceolate, erect, incurved. Tangiers. B.M. 6775. Gn. 36:720. G.M. 40:377.

84. **filifòlia,** Boiss., not Bunge (*Xiphion filifòlium*, Klatt.). Slender and leafy, about 2 ft. high, bearing 1–2 bright violet-purple fls. 2–2½ in. in diameter: lvs. about twice as long as the stem, weak, flexuous, convolute: outer segments with a narrow claw expanding suddenly into a reflexed, suborbicular lamina, bright yellow down the center; inner segments erect, obovate-lanceolate, erose, notched. S. Spain. B.M. 5928.—Int. 1869. Hardy.

85. **júncea,** Desf. (*Xiphion júnceum*, Klatt.). Stem slender, erect, rigid, 9–18 in. high, bearing 1 (rarely 2) golden yellow flowers, 2–3 in. in diam.: lvs. rigid, the lower 1 ft. long: outer segments with an orbicular blade shorter than the cuneate claw, recurved and veined with brown; inner segments erect, oblanceolate. May, June. Algeria, Tunis, etc. B.M. 5890. Gn. 54:1200.

86. **Boissièri,** Henriq. Lvs. 1 ft. long: stem about a foot long, bearing few, reduced lanceolate lvs. and a single flower: outer segments 1½ in. long; blade obovate, reflexed, as long as the cuneate claw, bright lilac, with a yellow keel running down the claw, slightly bearded; inner segments as long as the outer, erect, obovate, clawed, bright lilac. June. S. Portugal. B.M. 7097.

87. **reticulàta,** M. Bieb. Lvs. 2 in a tuft, short, erect, elongating to 1½ ft.: stem very short: fls. bright purple, very fragrant; outer segments 2 in. long, yellow at the claw, with a low yellow crest; inner segments narrower. Mid-April. Asia Minor and Persia. B.M. 5577. F. S. 5, pp. 507–9. R. H. 1890, p. 133. L. B. C. 19:1829. Gt. 779. Gn. 20:295; 54, p. 471. G.C. II. 11:501; 21:217. F. 1860:161. Var. **histrioìdes,** Foster (*I. histrioìdes*, Hort.). Outer segments much mottled with white and lilac on the claw and broad, orbicular blade. Asia Minor, Persia, and the Caucas. Gn. 42:880. J. H. III. 34:111.—Early-flowering, and fine for pots. Var. **Krèlagei,** Regel. Fls. red-purple, varying greatly in shade; claw conspicuously veined. The common wild form of the Caucasus. Nearly odorless. Var. **cœrùlea,** Hort. Azure-blue. Var. **cyànea,** Hort. Blue. Var. **màjor,** Hort. Like the type, but larger.

88. **Histrio,** Reichb. f. (*Xiphion Histrio*, Hook. f.). Plants tufted, slender and flaccid: lvs. deeply grooved on each face, 1 ft. long: stem half as high, very slender, 1-fld.: fls. 3 in. in diameter; tube 3–4 in. long, blue above; outer segments obovate-spatulate, spreading, deep blue, with a yellow line in the center bordered with white and spotted and shaded with blue; inner segments erect, oblanceolate, blue. Related to *I. reticulata*, differing only in its paler, odorless fls., which are produced several weeks earlier. Feb. Mts. of Palestine. B. M. 6033. Gn. 9, p. 29, and 33:653. G. C. III. 12:729; 21:105.

89. **Vártani,** Foster. Lvs. usually 2, 8–9 in. long, slender, finally longer: stem very short, hidden: tube 2½ in. long: outer segments with a narrow claw, suddenly enlarged into an ovate-lanceolate blade; pale, slaty lilac, with darker veins and a crisp yellow crest down the claw; inner segments erect, almost linear-lanceolate, pale lilac. Dec. Palestine, near Nazareth. B.M. 6942.—Not scented.

90. **Bakeriàna,** Foster. Lvs. 3–4, 6–9 in. long, finally a foot or more after flowering: fls. single, on a short peduncle, fragrant; outer segments with a long, obovate-elliptical claw, and a small, ovate, reflexed blade, intense violet, creamy in the center, with a yellow streak down the claw; inner segments shorter, erect, oblanceolate, lilac; style crests large. Feb., Mar. Armenia. B.M. 7084. Gn. 37:753. G.C. III. 7:293, and 21:103. J.H. III. 34:177. G.M. 40:118.

91. **Kolpakowskiàna,** Regel (*Xiphion Kolpakowskianum*, Baker). Lvs. 5–6, wrapped round by a sheath at the base, very short at the flowering time, but growing longer: scape very short, 1-fld.: outer segments with a long, erect claw and an ovate, acute blade, deep violet-purple with a yellow keel down the claw; inner segments oblanceolate, erect, pale lilac. Mts., Turkestan. Very near *I. reticulata*, fls. at the same time, and is sweet-scented. B.M. 6489. Gn. 17, p. 75, and 33:653.

SUBGENUS GYNANDRIRIS.

92. **Sisyrinchium,** Linn. (*Xiphion Sisyrinchium*, Baker. *Moræa Sisyrinchium*, Ker. *I. maricoìdes*, Regel). Stem 6–12 in. high, stout or flexuous, 1–3-headed: lvs. 2, slender, as long as the stem: fls. fugitive, lilac-purple, with a yellow, oblong spot on the outer segments, which are oblong spatulate; inner segments narrow-lanceolate, erect, pale: style crests large, lance-deltoid. Widely spread through S. Eu., Afr. and Asia. Easily killed by frost. B.M. 1407 (not good), and 6096. In *I. maricoides*, Regel, the filaments are said to be distinct from each other and from the style.

SUBGENUS JUNO.

A. *Lvs. hollow, tetragonous, produced after the flowers*..... 93. **Danfordiæ**
AA. *Lvs. linear complicate, short at the flowering time*....... 94. **Persica**
AAA. *Lvs. lanceolate, very short at the flowering time*......... 95. **Rosenbachiana**
AAAA. *Lvs. lanceolate, falcate at base; 3–9 in. long.*
B. *Stem 1–2-headed: inner segments pendulous.*
C. *Lvs. with a distinct white margin*........ 96. **Fosteriana**
CC. *Lvs. all bright green* ... 97. **Sindjarensis**
BB. *Stem 1-headed: inner segments spreading*........ 98. **Palæstina**
99. **alata**
BBB. *Stem 3–6-headed: lvs. 3–6 or 9 in. long.*
C. *Lvs. with a horny border*..................100. **Caucasica**
CC. *Lvs. without a horny border*...............101. **fumosa**
102. **orchioides**

93. **Dánfordiæ,** Boiss. Fl. stems 2–4 in. high: lvs. finally a foot long: fls. bright yellow, 1½ in. in diameter; outer segments with an orbicular blade spotted with brown; claw cuneate; inner segments reduced to minute, spreading, subulate teeth: style crests large. Spring. Cicilian Taurus. B.M. 7140.—Fragrant.

94. **Pérsica,** Linn. Bulb ovoid: lvs. 4–5, 2–3 in. long: stem short, 1-headed: tube 2–3 in. long: limb pale lilac: outer segments with an orbicular blade with a dark purple blotch, an orange keel, and purple lines and spots; claw auriculate; inner segments small. Should be lifted in summer. Asia Minor and Persia. B.M. 1. Gn. 11, p. 207; 14:156; 33:653; 54, p. 103 & 470. F.S. 10:1045. G.C. III. 7:577. Var. **purpùrea,** Hort. A bright purple variety. Fine. Krelage.

95. **Rosenbachiàna,** Regel. Lvs. 4–5, finally 6–8 in. long: stem short, 1–3-headed: outer segments obovate-cuneate; blade reflexed, white at the tip, deep purple in the middle and creamy below, with a yellow keel and dark lilac veins; inner segments spreading or reflexed, obovate, pale lilac. The color of the fls. is very variable. Mts., Turkestan. B.M. 7135. J.H. III. 28:189. G.C. III. 7:577. G.M. 34:171.

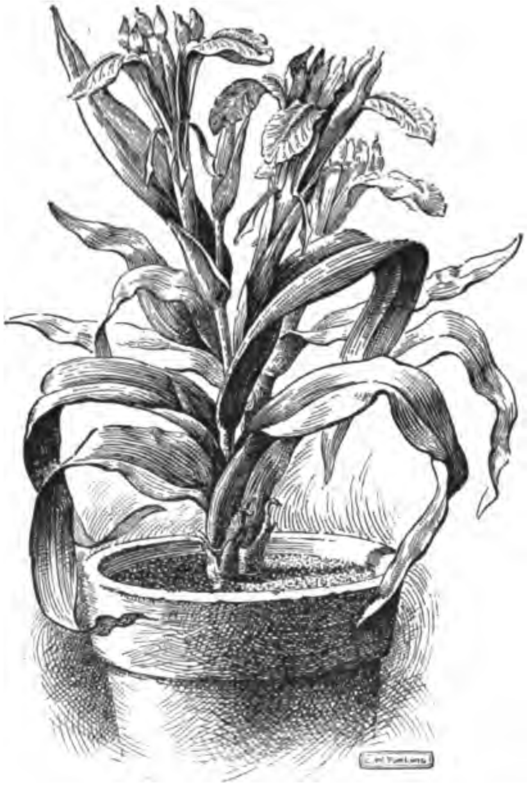
96. **Fosteriàna,** Aitch. Lvs. 4–6 in. long: stem short: outer segments yellow, streaked with black, obovate-cuneate; claw not auriculate; inner segments shorter, obovate, bright purple. March. Afghan and Russian boundary. B.M. 7215.—Very different from the allied species *I. orchioides*, *I. Sindjarensis*, etc., on account of the difference in color of the sepals and petals.

97. **Sindjarénsis,** Boiss. & Haussk. Lvs. about 8, crowded, 1 in. broad: stem short: fls. slaty lilac; outer segments with an obovate, reflexed blade narrowed to a claw, with darker lilac lines and a small yellow crest; inner segments oblong, clawed. Feb. Deserts of Mesopotamia. Plants half a foot high. B.M. 7145. G.C. III. 7:365. J.H. III. 28:227.

98. **Palæstina,** Boiss. Lvs. 3–6 in. long: stem very short: fls. pale yellow, tinged with lilac; outer segments oblong, upper ¼ reflexed; claw auriculate; inner segments minute, narrowly lanceolate. Fls. in winter. Mts. of Palestine. Very near *I. Caucasica*, but distinguished by its longer acuminate spathes and the color of the fls.

99. **alàta,** Poir. (*I. scorpioìdes*, Desf.). Lvs. about 6, plane, 6–9 in. long: stem very short: outer segments 3–4 in. long, obovate-cuneate, bright lilac, variegated with white, and having a yellow keel down the claw; inner segments obovate-unguiculate, spreading from the base of the outer: style crest large, laciniately toothed. Winter-flowering. Plants very dwarf. Spain to Sicily and Algeria. B.R. 22:1876. Gn. 10, p. 579 and 54, p. 102. G.M. 35:614.

100. **Caucásica,** Hoffm. Lvs. about 6: stem short: fls. pale or bright yellow; outer segments with an ovate blade and a very broad rhomboidal claw, with small auricles and a toothed or ciliated crest; inner segments oblanceolate. Dwarfer habit than *I. orchioides*. Caucasus to Asia Minor, etc.



1181. Iris orchioides (×¼).
A good species for pots.

101. **fumòsa,** Boiss. & Haussk. Lvs. about 10: stem 6 in. long: outer segments spatulate-oblanceolate, recurved above the middle, claw with a yellow crest; inner segments minute, spatulate, toothed. The fls. are greenish yellow, shaded with smoky gray. Dry fields, Syria.

102. **orchioìdes,** Carr. Fig. 1181. Lvs. about 6: stem 12–15 in. long, with distinct internodes: spathes 1-fld., 2 in. long: fls. yellow; outer segments with an obovate blade, and a purple blotch on each side of the crest of the claw; inner segments oblanceolate, less than an inch long, and generally sharply deflexed, with a long filiform claw. Spring. Var. **oculàta,** Maxim. Blade of the outer segments more spotted. Var. **cærùlea,** Hort. Fls. bright lilac, with a yellow blotch on the blade of the outer segments. Mts., Turkestan. B.M. 7111. Gn. 53, p. 482. R.H. 1880, p. 337.

Of the following names, which are found in catalogues, no complete description is available: *I. Assyriaca*. Bluish white. —*I. augustìna*. Deep yellow, marked with maroon. Gard. form of I. variegata.—*I. Battandièri*. White. Algeria. Bulbous.—*I. Bosniaca*. Yellow. Rhizomatous.—*I. brachysiphon*. Pale blue. Rhizomatous.—*I. Brittánicus*. Pale pink, with the outer segments veined with purple. Gard. form of I. squalens.—*I. Candiàna*. Outer segments reddish purple; inner segments light lavender. Germanica.—*I. Coreàna*. Like I. Sibirica, early and a free bloomer.—*I. edìna*. Light purple and violet. Var. of I. neglecta.—*I. Eggeri*. Blackish brown. Oncocyclus.—*I. Fisheri*. Apogon.—*I. flàva*. Pale yellow. Germanica.—*I. Gladstoniàna*. Hybrid of I. atropurpurea. Pale black, with yellow markings.—*I. grácilis*, Lichten.=Moræa tenuis. See also index given above. *I. ignitìtia*, probably Ignacite, a form of I. neglecta. Lilac, with the outer segment shaded purple.—*I. ligulàris*. Purple. Germanica.—*I. mónspur*, Foster=I. Monnieri × I. spuræa.—*I. nigricans*. Lvs. short ensiform: fls. dull black to deep black. Distinct from I. atropurpurea by its uniform dark color and dwarf foliage. Oncocyclus.—*I. páncrea*, probably pancrace. var. of I. variegata. Buff and purple.—*I. pàvar.*=I. paradoxa×I. variegata.—*I. Robinsoniàna*, F. Muell.=Morea Robinsoniana.—*I. Rùdini*, Hort., Herb. Fls. black-brown and claret. Said to be stronger and more free-flowering than the other Oncocyclus Irises.—*I. Sikkiménsis*. Lilac. Rhizomatous.—*I. stenophylla*. This plant was discovered in the Cilician Taurus in 1895–6. Haussknecht named it stenophylla without describing it. J. G. Baker gives a short description in G.C. III. 27:170. Near I. Persica. Lvs. 5–6, linear, tufted, channelled down the face, short and stiffly erect at the flowering time: fls. springing from the ground, the long tube lightly wrapped round by the lanceolate spathe valves; outer segments 2 in. long; blade reflexed, blackish blue towards the tip, with many black spots on a pale ground below it; inner segments small, horizontal: style branches lilac. Not in American trade. G.C. III. 27:171. Gn. 57:203.—*I. tuberòsa*, Linn.=Hermodactylus tuberosus.—*I. Vogeliàna*. Similar to I. Persica and I. Rosenbachiana, but earlier-flowering. Fls. variable in color, silver-gray predominating, with violet, rose or lilac markings. Var. grandiflora. Large-flowering.

The following numbers are not mentioned in catalogues of American dealers. They are procurable through foreign growers, and are advertised in Dutch-American catalogues: 1, 4, 5, 8, 29, 34, 38, 39, 40, 42, 51, 52, 53, 56, 58, 59, 62, 63, 64, 66, 67, 72, 80, 83, 84, 85, 86, 88, 89, 90, 91, 92, 93, 95, 96, 97, 98, 99, 100, 101, 102.

H. HASSELBRING.

IRIS-ROOT, or ORRIS-ROOT. *Iris Florentina.*

IRONBARK. *Eucalyptus.*

IRONWEED. Weed.

IRONWOOD, in America, *Ostrya Virginica.*

IRRIGATION. Irrigation in its broadest sense includes all problems of collecting, storing, delivering, and applying water to the land through the construction of dams, reservoirs, canals and laterals, and the application of power when necessary to deliver the water; while in a restricted horticultural sense it is a method of cultivation, having for its object to increase and regulate the water supply in the soil.

In this latter sense Irrigation is a necessary practice in the arid regions, and is advisable in the humid regions in proportion to the intensity of the cultivation and the value of the crop grown. Thus in Florida, with an average of 60 to 70 inches of annual rainfall—usually well distributed—Irrigation has been largely introduced in the past few years for horticultural crops and even for tobacco, as an insurance against loss or damage by the occasional droughts. The first cost of a small Irrigation plant in Florida, for 20 acres or over, is said to be approximately $100 to $150 per acre; the interest on which, and the necessary repairs, would amount to from $5 to $10 per acre per annum. This is a small expenditure to insure a crop against loss or injury where the value per acre is so great as in many horticultural lines. Irrigation is needed not only to prevent the actual death of the plants, but to promote a uniform, rapid, and continuous growth, which is necessary for the development of the finest texture or flavor of the commercial crop.

King has shown that the value of a crop saved in Wisconsin, such as the strawberry, in a season when the crops generally are injured by drought, may pay all the expenses of the original cost of the Irrigation plant.

In the semi-arid regions west of the 100th meridian, with a rainfall of from 20 to 30 inches, crops are liable to be entire failures three or four years out of five; while with an Irrigation plant there should not be a failure one year in five. In the arid regions with less than 15 or 20 inches of rain, Irrigation is a necessity on most soils. Here the work has been highly organized and systematized, so that the cost of water delivered at the field amounts from $2 to $5 per acre per annum. Under skilful management the most abundant yields are secured. The most careful management is required in the application of water to prevent serious injury to the land and to avoid actual injury to the crop in rendering the plants tender and liable to disease, and in maintaining the quality and flavor, both of which are liable to depreciate unless good judgment is displayed in supplying water.

Sources of Water Supply.—The principal sources of water supply are streams, surface wells, artesian wells, and the storage of storm waters. For small irrigated tracts near cities the city water supply may often be used to advantage. In other localities the nature of the conditions will determine the most economical source from which to obtain the water. Perpetually flowing streams, if situated in such a way that water can be carried to the land by gravity, have the advantage of cheapness of construction and maintenance. On the other hand, if the stream supplies others in the community, there is liable to be trouble and expense in establishing and maintaining water-right claims and in securing water when needed for the crop. Questions arising out of the water rights on streams and rivers in the western states, with the various state laws, the multiplicity of court decisions on the most intricate legal questions—both in different states and different counties along the line of the stream—the absence in most states of adequate police or judicial powers vested in the Irrigation commissioner, have led to the most perplexing and bewildering state of affairs, and have involved the states and individuals in enormous costs for law suits, resulting in many cases in the apportionment of many times the volume of the stream to the settlers along its bank.

The large planter must seek some perennial and abundant supply of water, as is furnished by streams, but it is safe to say that all streams of any size in the western part of the United States are already appropriated to their fullest extent, although the water so appropriated is not all in present use. Smaller planters are much more independent with some of the other sources of supply mentioned above. Wells from 10 to 20 feet deep, with pumps operated by windmills, or wells of a maximum depth of 50 feet operated by many forms of gasoline, hot air or portable engines, attached to direct acting pumps or centrifugal pumps, form in general a very satisfactory means of irrigating small areas.

Over limited areas artesian wells have been very successfully used. If they are flowing wells delivering a considerable stream, they can be used over small areas without storage reservoirs, or over much larger areas with reservoirs. They should be capped in all cases, where possible, so that the flow can be stopped when not actually needed.

In many places it is possible, at a comparatively small expense, to construct a dam to collect the storm waters. The magnitude and expense of such work will depend entirely on the configuration of the surface, the area of the watershed, the volume of the water to be handled as well as the nature of the soil, and the material out of which the dam is to be constructed.

Methods of Raising Water.—Various methods are used for raising water from streams, wells, or storage reservoirs which may lie below the general level of the land to be irrigated. Hydraulic rams are sometimes used for small areas, but these are not economical when a small volume of water is at hand, as only about one-seventh of the water can be collected. Open buckets carried on an endless belt, operated by either windmills, steam power or even horse-power, are used with success and offer the advantage of cheap construction. The ordinary cylinder or plunger pumps are usually employed when the water has little or no sediment, and are operated by windmills or by steam or other form of engine. When the water carries considerable sediment such pumps are liable to wear away rapidly, and the centrifugal pump is the most economical form to use. The relative first cost of equipment for pumping with windmills or with gasoline or hot air engines of approximately equal horse-power is about the same. The windmill, however, is dependent upon a mean velocity of wind of about eight miles per hour, while the engine may be operated at any time, and is thus more reliable when either form of motive power is taxed to nearly the extreme limit. There are many kinds of windmills on the market, and many forms of home-made construction are in use.

Storing and Conducting Water.—Storage reservoirs for streams and for storm waters vary in size and in cost as well as in mode of construction, according to the character of the land, size of area, volume of water, nature of the material of construction, and demand for the water. The construction of such reservoirs sometimes involves engineering problems of the most difficult kind, demanding the expenditure of immense sums of money.

In the use of windmills it is necessary to have small distributing ponds or tanks, as the direct flow from the pump is usually so small and varies so much with the velocity of the wind that it cannot be depended on to water any considerable area. Where it is stored it can be turned out onto the land in large volumes, so that it spreads over the surface and waters the whole area uniformly. For an ordinary windmill the ponds are from 50 to 100 feet square. They can be stocked with fish and thus be a source of some revenue and variety in the family supplies. Unless the pond is situated on a slight elevation, the earth for the embankment must be taken from the outside. The banks are usually made with a slope of 1½ to 1 foot. For a bank 5 feet high and 2 feet across the top, the side would be about 7½ feet and the base about 17 feet wide. If the ground is at all pervious to water, the bottom of the pond should be protected from undue seepage and loss of water by puddling. This should be done with clay, if this is obtainable. This puddling is often done by driving horses or cattle in the pond while the surface is wet. A pond of the size indicated above, operated by a windmill where the mean wind velocity is about 8 miles per hour, will irrigate from 3 to 5 acres of land in the semi-arid regions. Such a pond could be counted upon to irrigate from 5 to 10 acres where, as in the East, only one or two irrigations would be required during the season. The size of the reservoirs and the area they will irrigate, when supplied by steam or other kind of engine, will depend upon the available water supply and upon the size of pump and power used.

Ditches and Flumes.—The water is usually carried from the stream or storage reservoir by gravity in open ditches. This involves loss by evaporation from the surface and by seepage through the soil. When the water supply is limited and its value is consequently great, terra-cotta pipes, iron pipes, cement or wooden pipes may be used. When the surface of the country is uneven and ravines have to be crossed, flumes are used to carry the water on an even grade across the depression. These flumes may be iron pipes, open wooden troughs, or wooden pipes held together with substantial hoops. If the depression is not too great the ditch may be built up on an earth embankment. When the water has to pass through a gravelly soil, or when for other reasons the soil is very pervious, special precautions should be taken to prevent seepage by using pipes, cementing the sides of the open ditch, or puddling the ditch with clay, or similar material.

Application of Water.—The water is usually applied to the ground by flooding over the whole surface. For this purpose the surface must be perfectly level and the ground carefully prepared, so that the water will flow uniformly and quickly over the entire area and be of uniform depth throughout. Where crops are cultivated in rows or on beds the water is allowed to flow down in the troughs between the rows, and there must be a sufficient head of water to reach the end of the rows in a reasonably short time, so that the whole width of the field will be properly watered.

Where the surface of the ground is so uneven that surface flooding cannot be used, basins are formed by throwing up slight ridges, with a plow or other implement, and the water turned into these basins in succession and allowed to accumulate to a sufficient extent. This method is particularly applicable to fruit trees, although it is occasionally used in other crops. In very sandy soils the water is occasionally carried through the field in wooden troughs, which admit of sufficient seepage to water the land. This prevents the undue seepage which might occur in such soils if the water was flowed over the surface. Another method is to distribute the water through the field in iron pipes, with openings at frequent intervals, in which nozzles can be attached to deliver a fine spray over a small area. With four or five such nozzles an attendant can water a considerable area of ground in the course of a day. Such an irrigating outfit in Florida was supplied with a power equivalent to about one horse-power per acre. The mains and laterals were of 1-inch or 1¼-inch iron pipes laid near the surface of the ground, the laterals about 100 feet apart, with hydrants every 50 feet. Tanks were originally used, but it was found desirable to pump directly into the mains to insure a sufficient pressure.

Care should be exercised in applying water to the land. Where water is plentiful there is a common practice of using such an excess as to injure the flavor of fruit, increase the liability of disease, and eventually injure the land by the accumulation of seepage waters and of alkali. As a rule, there has been very much more damage from over-irrigation than from the use of too little water. The first two or three years a soil usually requires a considerable amount of water, but after becoming well moistened to a considerable depth it should require comparatively little water thereafter to maintain its fertility. As it is not easy to apply just the proper amount, the excess should be provided for. If there is any reason to fear lack of drainage, the land should be thoroughly underdrained before irrigation is started, or at any subsequent time when the need of it becomes apparent.

Irrigation always should be supplemented by the most thorough cultivation. After going to the expense of watering the soil in this way, it is poor economy to allow the water to escape by evaporation or otherwise; therefore every precaution should be used in thorough, subsequent cultivation and in the exclusion of weeds, to conserve the moisture so applied. The intelligent horticulturist will find that in the use of this expensive method of maintaining a proper water supply in the soil, it is incumbent upon him, even more than if the method were not used, to give careful attention to all the ordinary methods of preparation and cultivation in order to maintain the advantages he has established by the irrigation plant. MILTON WHITNEY.

SUB-IRRIGATION IN THE GREENHOUSE.—The term sub-irrigation is used to describe a method of supplying water to the roots of plants by means of some form of conduit placed below the surface of the soil. In greenhouse operations, the essential features of the plan are a level, water-tight bench-bottom, and tile or pipes to serve as conduits for the water. The tile, or pipes, are laid directly on the bench bottom, and over these the soil is spread, usually to the depth of about 6 inches. When water is introduced in sufficient quantities through the tile or pipes, it passes out at the joints or perforations into the soil.

When applied to greenhouse operations, the term sub-watering has been proposed by Goff and Cranefield for the reason that irrigation is used to denote watering on a large scale out-of-doors. It may be said, however, that the words watering and irrigation do not indicate the scale of operations with any degree of accuracy, hence it seems as well to use an old word as to coin one, especially when the familiar word expresses the meaning intended.

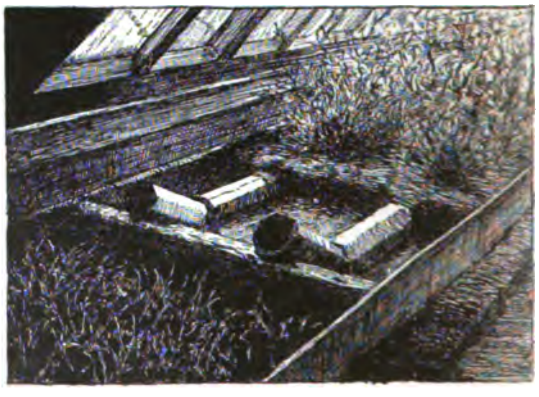
Experiments in watering plants by this method were begun in the winter of 1890 and 1891, at the Ohio Experiment Station. The suggestion came from the result obtained in an effort to check the lettuce rot. Water was introduced to the soil in boxes by means of a pipe, in a similar manner to the method often employed in watering hills of melons and cucumbers. When the plants were watered in this manner, the lettuce showed so much more vigor than that watered in the ordinary way that operations were begun at once on a larger scale: first in a bed on the ground having a clay bottom, then on a water-tight bench, made of lumber, and finally, on tile benches, covered with cement.

In all of the earlier experiments the water was introduced through pipes, or drain-tile, laid about 2 feet apart on the bottom of the benches. Goff and Cranefield have used brick instead of tile, placing them near enough together to touch. They were set on edge in a galvanized-iron pan, made for the purpose. J. C. Arthur clipped off the corners of the bricks, so as to facilitate the flow of water. The Ohio Station has modified this plan by using common drain-tile, laid so as to touch, thus covering the entire bench bottom, instead of a line of tile every 2 feet, as at first.

Benches made of lumber have proved unsatisfactory because of the swelling and warping of the boards. Solid beds on the ground have not been successful, except where an impervious clay bottom existed. Galvanized-iron adds greatly to the cost of construction, and lasts only a short time. The only suitable bench for greenhouse sub-irrigation is one made of materials which are not acted upon by water.

A well-made tile- and cement-bench seems to be the only form of construction that will meet the requirements. Such a bench does not cost so much as to preclude its use, and will last as long as any other part of the greenhouse. In describing such a bench, it will not be necessary to enter into details, except such as relate to the method of watering under discussion. The bench must be water-tight, or nearly so, and this condition is secured by spreading a layer of cement, an inch or more in thickness, over the tile bottom. It is not a matter of any moment whether flat tile or common drain-tile are used, except in the quantity of cement required. The cement must be spread with care, so as to secure a perfectly flat, level bottom, otherwise the water will not flow uniformly in all directions. The sides of the benches are made of cement also, but need be only 2 or 3 inches high, or of sufficient height to merely retain the water. Boards or slate are placed outside the cement wall to retain the soil. The tile-bottom may rest on iron or wood cross-pieces. Wood has been in use for this purpose at the Ohio Station for seven years and shows no signs of decay, because it is out of reach of the water.

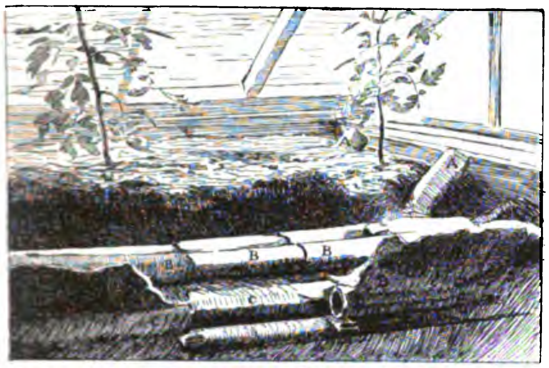
Nine years' experience shows that a perfectly constructed bench bottom, with the tile laid 2 feet apart, will serve satisfactorily in distributing the water to all parts of the bed, provided the tile are straight, so as not to impede the flow of water. The tile are laid in the same manner as tile-drains, and lengthwise or crosswise the bed, as preferred. Better results are usually secured if they are laid crosswise than lengthwise, as it is difficult to secure an even flow through long lines of tile. A little cement or mortar is used at each joint merely to hold the tile in place when the soil is put in the bench, but not enough to impede the flow of water from the



1182. Sub-irrigation with two runs of tile.

joints. The first tile where the water is introduced is laid at an angle, one end resting on the edge of the bench side. This leaves a wide opening at the first joint, which is closed with cement. A better plan is to use a curved sewer-pipe for the inlet, but this is not always available. The picture (Fig. 1182) shows how the tile is laid on the bench bottom, being a view of a side bench in a carnation house.

Following Goff's suggestion in the use of brick, tiles have been used over the entire bench bottom with good results, and it seems probable that this will be found to be the best form of construction, as it appears more certainly to insure an even distribution of water. The method of construction is the same as above described, for the two plans differ only in the number of tiles employed to distribute the water. When the bench bottom is covered with tile, placed near enough together so that the soil will not fall between, it will be readily seen that water introduced at any point will flow to all parts of the bed in and around the tile. It needs simply to be brought up to such a level that it will reach the soil, when capillary attraction will complete the distribution. Fig. 1183 shows a bench in a tomato house constructed after this plan. AA are the inlets; B the irrigating tile, from which the soil has been removed; C is the tile bench bottom, covered with cement. The same size of tile, viz., 2½- or 3-inch, is used both above and below. D is the cement side, which has been broken away to show the method of construction. The outer board has been removed also.



1183. Sub-irrigation with two tiers of tile.

The cost of construction need not be discussed here, except to state that the only items extra, more than are required in any well-constructed greenhouse, are the cement bottom and the tile in which the water is distributed.

A plan has been devised for applying water to small plants in flats which may properly be mentioned under this head. The flats are shallow boxes with slatted bottoms. When the plants require water, the flats are placed in a shallow vat of water and allowed to remain until the surface of the soil appears to be damp, or even wet.

A watering in this manner is far more efficient than by the ordinary method. Taken in connection with sub-irrigation in the benches, a crop of lettuce can be brought to marketable size nearly two weeks earlier than when surface watering is practiced. Anything like a full discussion of results of experiments in watering plants in the greenhouse by sub-irrigation would be too voluminous for an article in this connection. A brief review of the results obtained at some of the stations, together with a short discussion of some general principles, will serve the purpose intended. The increase in weight of lettuce from sub-irrigated plats over those watered in the ordinary manner has been reported by Rane, of West Virginia, as 25 per cent and by Goff and Cranefield as 26 per cent. At the Ohio Station the range has been from 25 to 100 per cent. In the latter case the result was obtained by commencing with the plants as soon as taken from the seed-bed, and carrying the two lots through to the termination of the experiment, one by watering altogether on the surface of the soil, the other by sub-irrigation. Each of the experimenters speaks of a gain in earliness of several days by sub-irrigation. Rane secured similar results with long-rooted radishes by this method of watering, but not with the turnip-rooted sorts, while Munson, of Maine, doubled the crop by watering below. Better results have usually been secured at the Ohio Station with the turnip-rooted than with the long varieties, but in all cases there has been a gain in favor of sub-irrigation, varying from 50 to 100 per cent. Rane found that sub-irrigation increased the yield of tomatoes, but the gain was not large. Essentially the same results have been secured in Ohio. The tomato crop has not been greatly influenced by the manner in which the water was applied, and the same is true of beets, while sub-irrigated cucumbers and parsley have shown a decided gain over surface-watered. Carnations, roses, chrysanthemums, sweet peas, violets and smilax have been under experiment by the two methods of watering, and while no such marked results have been secured as with lettuce and radishes, the sub-irrigated plots have shown superiority over those watered in the ordinary manner, in nearly all cases. With carnations the improvement has been mainly in length and stiffness of stem.

Aside from the increase of crop secured by sub-irrigation, there are other considerations which may be urged in its favor, and these are embodied in the following general propositions:

(1) *Watering by sub-irrigation in the greenhouse saves labor.* The amount of labor saved depends mostly on the completeness of the arrangements for watering, but there is a saving in the number of applications as well. It is possible to reduce the time employed in watering a house, or series of houses, to one-fifth the time usually required.

(2) *Watering by sub-irrigation assures an abundant and uniform supply of water to all parts of the bed.* Perfect construction of the benches is assumed in this case, but with such construction watering becomes almost automatic, the only care necessary being to look after such portions of the beds as may, by position, be subject to unusual conditions of air or sunlight.

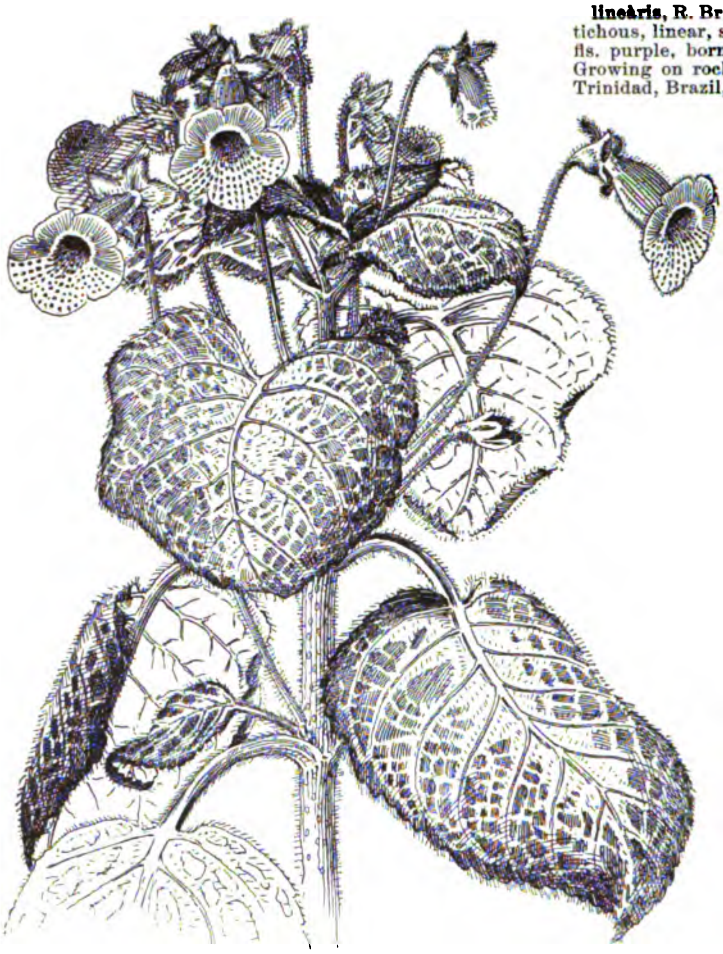
(3) *Where sub-irrigation is practiced in the greenhouse, the surface of the soil does not become compacted, but retains its original loose, friable condition.* It is true that where frequent syringing is practiced the surface of the soil becomes more or less hardened, but not to the extent that occurs in surface-watering, and the condition is easily remedied, whereas in the other case it is not. It follows that a heavier soil may be used for sub-irrigation than with surface-watering.

Still other considerations might be urged in favor of this method of watering, but many of them would apply to special cases only. Regarding the effect of the method upon insects and diseases, but little can be said. Lettuce rot is less prevalent upon sub-irrigated plots than upon those which are surface-watered, but in extreme cases plants succumb to the disease, whichever method of watering is practiced. Munson found that radishes suffered more from the attacks of millipedes upon sub-irrigated plots than upon plots watered in the usual manner. Nematodes work upon the roots of roses, whichever way the plants are watered. The manner of watering has no apparent effect upon the red spider. Even in houses watered wholly by sub-irrigation this pest is no worse than in houses in which the water is applied to the surface of the soil. It may be said, however, that nearly all classes of plants are more easily kept in a healthy growing condition, and are thus better able to resist enemies of all sorts, when sub-irrigated than when supplied with water in the ordinary way.

This method of applying water to plants in greenhouse benches has now been sufficiently tested to determine its value. All that now remains is to devise ways and means to utilize what is known concerning it. The adaptation to suit particular cases must be made by individuals, but this will be far easier in the future than in the past, because better methods of construction prevail than formerly. The success of sub-irrigation in the greenhouse is now simply a question of mechanics.

W. J. Green.

ISÀTIS (meaning obscure). *Cruciferæ.* This includes the Dyer's Woad, *I. tinctoria,* formerly cult. for a blue dye, but no longer advertised. Cæsar relates that the ancient Britons used the Woad for staining their bodies, and the word Britain itself comes from an old Celtic word meaning painted. Before indigo became common in Europe, the Dyer's Woad produced the chief blue coloring matter for woolen cloth. The introduction of indigo in the seventeenth century destroyed this important industry, not without opposition. Dioscorides and Pliny mention both the Dyer's Woad and indigo.



1184. Isoloma Tydæa (× ⅓).

I. tinctòria, Linn., is rather tall, glabrous and glaucous: stem-lvs. lanceolate, entire, sessile, somewhat arrow-shaped: fls. small, yellow, borne in early summer, on panicled racemes. Instead of a pod, opening lengthwise by valves, it has a closed fruit like on the samara of an ash, 1-celled, 1-seeded, indehiscent, wing-like. It is a biennial, and common in Europe.

ISCHÀRUM. See *Biarum.*

ISMÈNE. Now referred to *Hymenocallis.*

ISNÀRDIA. Includes a few species of *Ludwigia.*

ISOCHÌLUS (Greek, *equal lip*). *Orchidàceæ.* A genus of no commercial value. Plants epiphytic, with tall, slender, leafy stems, without pseudobulbs, bearing a few small fls. at the summit. Sepals erect, free, keeled; petals similar but plane; labellum like the petals and united with them to the base of the column, somewhat sigmoid below the middle: column erect, long, without wings: pollinia 4. About 5 species in Braz., Mex., and W. Ind.

lineàris, R. Br. Slender, 1–1½ ft. high, leafy: lvs. distichous, linear, striate, obtuse, emarginate, 1½ in. long: fls. purple, borne in a short, terminal spike. March. Growing on rocks and trees in thick woods, Jamaica, Trinidad, Brazil, etc. B.R. 9:745. L.B.C. 14:1341.

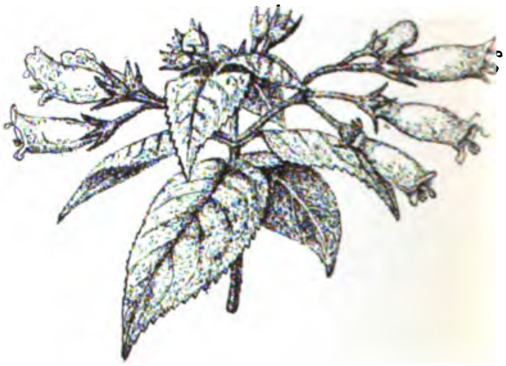
H. Hasselbring.

ISÓLEPIS. See *Scirpus.*

ISOLÒMA (*equal border*). *Gesneràceæ.* Includes *Tydæa.* Sixty or more tropical American plants, very closely allied to Gesneria and Achimenes. From Gesneria distinguished by absence of well-formed tubers and characters of capsule and anthers, and the 5 lobes of the disk equal; from Achimenes in the more tubular flowers and lobed disk. The culture is the same as for Achimenes and Gesneria. Seeds of the newer hybrids germinate quickly, and plants bloom the same year. It is probable that the pure species are not in the trade. Like Achimenes, Gesneria and Gloxinia, they have been much hybridized and varied. It is probable that they are hybridized with Achimenes and Gesneria. Tydæa is a garden genus. It is not known how the current forms have originated. Some of the recent ones have fringed fls. (Gn. 55:1223).

Tydæ̀a (*Achimènes picta,* Benth. *Tydæ̀a picta,* Dcne.). Fig. 1184. One to 2 ft., hairy: lvs. cordate-ovate, coarsely serrate, spotted and reticulated with pale green or silvery green, with a broad light zone down the center: fls. single, on long, axillary stems, nodding, the orifice oblique and lobes obtuse, the upper longitudinal half of the fl. red, the lower half yellow and red-spotted. Colombia. B.M. 4126 (adapted in Fig. 1184). B.R. 31:42. F.S. 1:17-18.—On this species Decaisne founded the genus Tydæa in 1848. This species has been called *Isoloma pictum,* but this name was taken by Planchon in 1850 to '51 for the *Gesneria picta* of Hook., which is a very different plant. See F.S. 6:586. B.M. 4431. This latter plant, the first *Isoloma pictum,* is apparently not in commerce.

amàbile, Mottet (*Tydæa amàbilis,* Planch. & Lind.). Erect, hairy: lvs. ovate, more or less tapering to the petiole, bluntly serrate, purplish on the veins: fls. hairy, pendent, dark rose dotted with purple, paler inside. Colombia. B.M. 4999. R.H. 1859, p. 25. F.S. 10:1070.



1185. Isoloma Jaliscanum (× ⅓).

Ceciliæ, Nichols. (*Tydæa Ceciliæ*, André). Much like *I. amabile*, but lvs. marked with violet and silvery zones or blotches: fls. 2 or 3 from each axil, the fls. pale rose outside and striped in the throat, and the limb purple-spotted. Colombia. I.H. 23:260.

ocellàtum, Benth. & Hook. (*Achimènes ocellàta*, Hook.). Short-hairy on the stem: lvs. ovate-acuminate, serrate, green: fls. small, on peduncles shorter than the lvs., the tube and short, rounded lobes red, the segments marked with whitish and black spots. Panama. B.M. 4359.

Jaliscànum, Wats. Fig. 1185. Herbaceous or some what woody at the base, 1 ft., pubescent: lvs. opposite, oblong-lanceolate to ovate-lanceolate to ovate, short-acuminate, short-stalked, serrate: fls. 2–4 on an axillary peduncle, the corolla an inch long, tubular and short-lobed, pubescent, scarlet. Mex.—A worthy plant, not yet in the trade, but has been cult.

L. H. B.

ISONÁNDRA (Greek, *equal anthers*). *Sapotàceæ*. *Isonandra Gutta* is a large-leaved E. Indian tree, which furnishes the best commercial gutta-percha. The name has appeared in one southern catalogue, but the plants were found to be not true to name. This plant should be called *Dichopsis Gutta*. In Dichopsis the floral parts are in 6's, stamens 12, and the seeds have no albumen, while in Isonandra the floral parts are in 4's, the stamens 8, and the seeds albuminous. See *Rubber Plants*.

Gútta, Hook. Properly *Dichópsis Gútta*, Benth. & Hook. GUTTA-PERCHA TREE. Lvs. leathery, elliptic, abruptly pointed Malaya. R.H. 1898, p. 441.

ISÓTOMA (Greek, *equally cut;* referring to the corolla, and true only by contrast with Lobelia). *Campanulàceæ*. This includes a plant treated as a half-hardy annual, which grows about a foot high, has curiously cut foliage, and odd fls. with a slender bent tube 1 in. or more long, and 5 slender spreading lobes, each ½in. long. Among allied genera of garden value, Centropogon and Siphocampylus have the stamens fastened at the base of the tube, while in Isotoma they are at the top or above the middle. (Centropogon has an indehiscent berry: Siphocampylus a capsule 2-valved at the top like Isotoma.) Downingia has a tube of stamens free from the corolla.

axillàris, Lindl. Perennial, flowering the first year so as to appear annual, but forming at length a hard rootstock, erect, with few spreading branches: lvs. linear, irregularly pinnatifid, 2–3 in. long, lobes linear: pedicels axillary, 2–6 in. long: fls. large, bluish purple, pale outside. Australia. B.M. 2702 (as *Lobelia senecioides*) and 5073 (as *Isotoma senecioides*, var. *subpinnatifida*).—Not in cult.

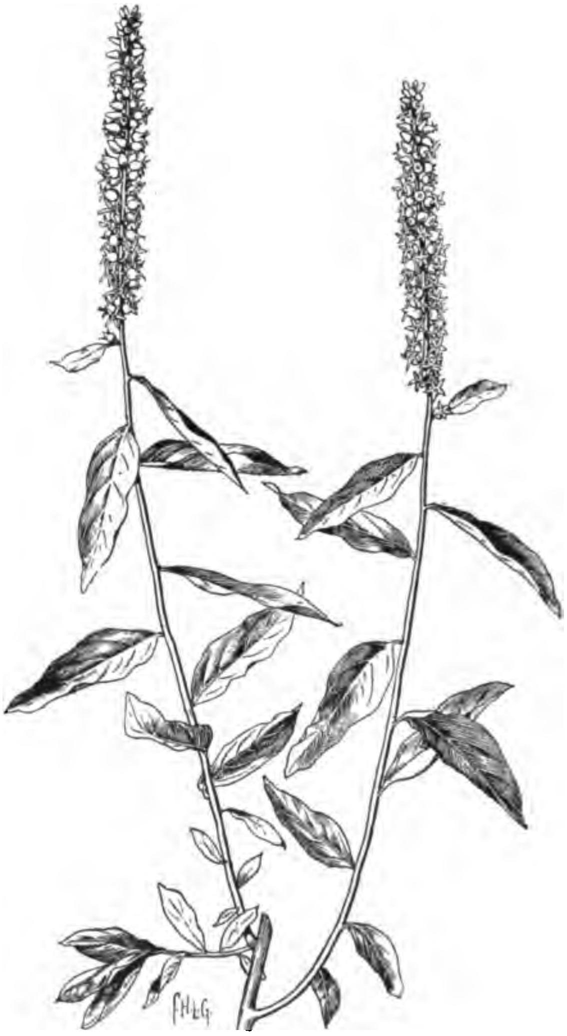
petræa, F. Muell. Identical with the above, except that the lvs. are ovate-oblong or elliptical. Australia. The plant in the trade is said to have cream-colored fls., and is sold as a "Lemon Verbena," a name which properly belongs to Lantana.

ITALIAN MAY. *Spiræa hypericifolia.*

ITÈA (Greek name of the willow; because it has willow-like lvs., and grows near the water). *Saxifragàceæ*. A genus of trees and shrubs, numbering about 5 species, inhabiting eastern N. Amer. and eastern Asia, whose one representative in cultivation is *I. Virginica*, a low, upright, somewhat coarse shrub, best known by its long, upright racemes of small white fls. appearing about July 1, in Massachusetts, and its brilliant autumn coloring. In nature it inhabits low, wet places. In cultivation it seems to adapt itself to almost any soil. It is not perfectly hardy, but grows rapidly and seems enduring of both sun and shade. In ornamental use it is planted in masses or mixed with other shrubs of similar character in the shrubby border or at the edge of woods. Its somewhat coarse character does not favor its approach to more refined objects. In autumn it becomes a brilliant red. It is prop. from seed, by cuttings and by division of roots, which spread slowly and form clumps of stems. It may be collected from the wild.

Virginica, Linn. VIRGINIAN WILLOW. Fig. 1186. A shrub, 1½–6 ft. high, usually not more than 2–3 ft. high, of upright, somewhat slender habit: lvs. deciduous, alternate, oblong, pointed, minutely serrate, smooth green above, pale and slightly pubescent below, petioled, without stipules, 1–3 in. long: fls. regular, 3 lines long, fragrant, white, in solitary, erect, hairy, simple, dense, terminal racemes 2–6 in. long, given a greenish white effect by the stamens and pistils, not particularly showy, appearing late June and July; calyx 5-cleft, persistent, nearly free from the base of the ovary; corolla of 5 lanceolate, nearly erect petals and longer than the 5 stamens: capsule slender, longitudinally 2-furrowed, 2-celled, many-seeded, splitting through the simple style and partition. Pa. and N. J. to Fla. and La. B.M. 2409.

A. PHELPS WYMAN.



1186. Itea Virginica (×⅓).

ÌVA (named after *Ajuga Iva*, from its similar smell). *Compósitæ*. This includes **I. frutescens**, Linn., the Marsh Elder or High-water shrub, a native hardy perennial of no garden value, which is, nevertheless, on record as having been cult. It grows 3–12 ft. high in salt marshes and on muddy seashores, has serrate lvs. and fls. as inconspicuous as those of a ragweed. See B.B. 3:292 and Gray's Manual.

IVÈSIA. All referred to *Potentilla*.

IVY. The common or English Ivy is Hedera. **Boston I.**=*Ampelopsis tricuspidata*. **German I.**= Climbing *Senecio* and *Herniaria glabra*. **Ground I.**=*Nepeta Glechoma*. **Kenilworth I.**=*Linaria Cymbalaria*. **Poison I.**=*Rhus*, *R. Toxicodendron*. Some authors think that two species of Rhus are confused, *R. radicans* being the common Poison Ivy of the North, and *R. Toxicodendron* being a shrub of the South.

ÍXIA (Greek, *bird lime;* said to refer to the juice). *Iridàceæ.* Ixias are delightful tender bulbs originally from the Cape of Good Hope, with attractive grass-like foliage and spikes of flowers borne in early spring, exhibiting an exceptionally wide range of colors. They grow about 1½ ft. high on the average, with an unbranched stem, a spike 3–8 in. long, containing 6–12 fls. each 1½–2 in. or more across. The fls. have a very slender tube usually about ½ in. long, and 6 segments. The following colors are all well marked in Ixia: white, yellow in at least 3 shades, orange, lilac, rose, pink, crimson, light and dark purple, ruby red, pale blue, and even green. Perhaps the only important colors lacking are sky-blue and red in the bright shades of scarlet and vermilion. The flowers may be concolorous (all of one color) or these same shades may be combined with an eye. Most of our cultivated forms seem to have an eye of brown, purple or almost black, but there have been kinds with a white, blue or green eye. Occasionally there is a ring of brown color above the purple. Add to this that the backs of the segments may be more or less suffused with various colors (usually, however, that of the eye) and the interesting possibilities of Ixias in color combinations can be imagined. Sooner or later all good gardeners yield to the fascination of bulbous plants, and whoever has not yet succeeded in growing Ixias has something to live for.

1187. Ixia flowers in their drooping stage. (× ½.)

Ixias number their cultivated varieties by the hundreds. Next to Crocuses and Freesias they have no rivals in point of popularity among spring-blooming bulbs of the important Iris family, which rejoices in the possession of such splendid summer-blooming bulbs as Iris, Gladiolus and Montbretia. Culturally they belong to the same class with Babiana and Sparaxis, which are also desirable and distinct in general appearance and coloring, but are outstripped by Ixias in popularity and in number of varieties. Botanically, these three genera belong to the Ixia tribe, in which the fls. are spicate, not fugitive and never more than one to a spathe. The stamens of Ixia are equilateral; those of Babiana and Sparaxis unilateral. Ixias have about 6 erect grass like lvs. arranged in 2 ranks; Babiana has plaited, hairy lvs.

Bulb catalogues give no hint whatever as to the parentage of the numerous named varieties. Not one of them mentions *I. maculata* nor *I. columellaris*, which were the two all-important parent stocks. Of the 23 species recognized by Baker in Flora Capensis, vol. 6, 1896, only *I. viridiflora* appears as a trade name, but *I. speciosa* and *paniculata* are advertised under their synonyms *craterioides* and *longiflora*. *I. crocata* is *Tritonia crocata*, and *I. hybrida* of the trade is not the *hybrida* of the botanists, but means nothing more than mixed varieties.

Before speaking of the dominant types, it is convenient to mention some very distinct species which are still cultivated in a condition not essentially different, botanically, from the wild types. *I. paniculata* is instantly distinguished from all other Ixias in cult. by its very long tube, which is often 3 in. long. It is also the last to bloom. *I. viridiflora* is unique in the genus for its green flowers, and it is one of the few green-flowered plants that are attractive. Whether this species has hybridized with the other dark-eyed species is conjectural. At any rate, the prototype is a popular plant to-day.

Of 86 named varieties received from 3 leading dealers in America, England and Holland, and supposed to be a representative collection, all but a bare dozen seem to be the offspring of *I. maculata* and *I. columellaris*. Both of these species have a purple or purple-black eye, sometimes brown, and the white and yellow colors of the segments are derived from *maculata*, while the lilac and purple shades of the segments are derived from *columellaris*. Baker makes no distinction between these two prototypes except that of color. The common opinion is that Ixias hybridize freely, both at the Cape and in cultivation, and it is usually said that they are now so thoroughly mixed by hybridization and selection that it is impossible to refer any of the named horticultural varieties to their proper species. Nevertheless, from a study of the specimens mentioned above and the colored plates cited below, the writer ventures the opinion that the vast majority of cultivated Ixias are eyed forms, which, with the exception of *viridiflora*, can be readily referred either to *maculata* or to *columellaris*, and that all such forms could be reproduced without hybridization if the original types were reintroduced from the Cape and subjected to an equal period of selection.

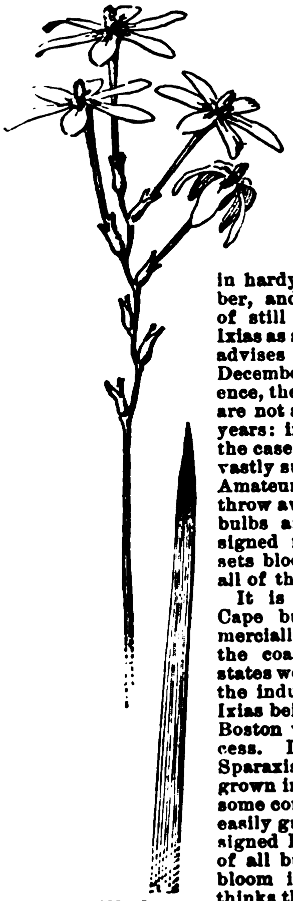
The real mystery in Ixia is why the self-colored forms are so little cultivated. There are at least 7 species with self-colored fls. which should be obtained directly from the Cape, if necessary, for they would all make decided additions to the Ixias that are in common cultivation. These are: *polystachya*, pure white; *flexuosa*, white, veined rose, with fine red and purple varieties: *aristata*, a superior pink; *lutea*, orange; *patens*, bright red; *speciosa*, ruby-red, and *odorata*, yellow. Of the eyed forms *ovata*, a bright red flower, should be added, as this color seems to be lacking among the varieties that are commonly cultivated; also *monadelpha* in its variety with pale blue segments.

One of the most desirable of all these little-known types is *I. speciosa*, which is shown in the Botanical Magazine, with a delightful ruby-red color, untouched with any suggestion of purple, lilac or allied shades. This form would seem to promise to the hybridizer the possibility of several distinct shades of red that now seem to be practically unknown in cultivated Ixias. A synonym of *I. speciosa* is *I. craterioides*, which is a common trade name, but it is doubtful if the ruby-red form is in general cultivation. At any rate, it has not been sufficiently exploited. The dearth of good colored plates of modern cultivated Ixias is out of all proportion to their commercial and artistic value. The writer has no record of any good one since that published in 1884 in "The Garden."

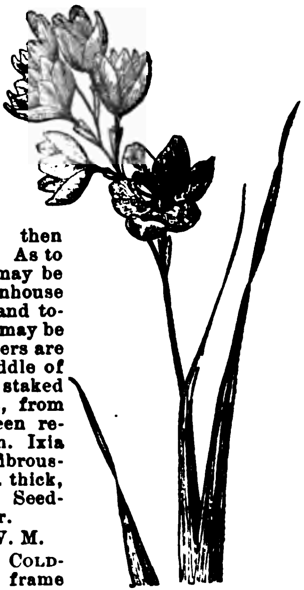
Ixia flowers are charming in every stage of development. At first the flowers are erect and cup-shaped. They close at night and remain closed on dark days. As they grow older they open wider and become more star-shaped. The reader may judge by Fig. 1187 of the beauty of the flowers in their drooping stage. The plants remain in flower for three weeks, though the faded flowers at the bottom of the spike should be taken off toward the end of the period. As cut-flowers, they are presentable for a week or two. W. M.

CULTURE OF IXIAS OUT-OF-DOORS.—The writer has always liked Ixias, but has considered that it is too much trouble to grow them under glass. They are vastly more satisfactory when grown outside. The planting of the bulbs should be delayed until the last moment, because Ixias are more inclined than most things to make an autumnal growth. They should be planted 3 inches deep, as late as November 30. In planting bulbs it is always well to sprinkle a handful of sand on the spot where the bulbs are to lie. This helps the drainage, especially on heavy lands, and prevents rotting. The bulbs should then be covered with about 3 inches of leaves, hay, or better still, pine needles. In the latitude of Boston, bulb beds can be uncovered during the first week of April. However, there will still be sharp frosts to nip the tender shoots that have started beneath the winter covering. Consequently a little hay or other covering material should be left near by, where it can be easily gotten when a chilly evening threatens. In ten days the young sprouts will become sufficiently hardened to withstand any subsequent cold. Even such hardy things as Alliums, when first uncovered, can hardly withstand any frost at all. It is, however, a mistake to wait two weeks longer and then permanently uncover the bulb beds, for by that time the early-starting things are likely to be so lank and long that they never attain ideal sturdiness. It is better to uncover too early than too late. The secret of success with Ixias outdoors is largely in hardening the plants in early spring and in never allowing them to grow too fast under cover, where they become yellow and sickly. During the winter shutters can be placed over the bulb beds to shed the rain; but the bulbs do as well without this protection, though they may be later in starting. Of course, Ixia bulbs cannot stand any freezing, and they must, therefore, be planted in unfrozen soil. After flowering, let the bulbs remain in the soil until the end of July: then take them up, and store them, not in dry earth, but in boxes without any packing. Let them remain in a dry place until they are wanted for November planting. In the southern part of England Ixias can be planted 6 inches deep in hardy borders as late as December, and Krelage, perhaps thinking of still warmer regions, considers Ixias as summer-blooming bulbs, and advises planting from October to December. In the writer's experience, the flowers from the old bulbs are not at all inferior in succeeding years: indeed, the contrary has been the case, and the bulbs he raises are vastly superior to the ones he buys. Amateurs are commonly advised to throw away the offsets because fresh bulbs are cheap. Yet the undersigned finds that many of the offsets bloom the first year and nearly all of them the second.

It is commonly thought that if Cape bulbs are ever raised commercially in America, California or the coastal plain of the southern states would be the fittest regions for the industry. The writer knows of Ixias being raised commercially near Boston with every prospect of success. It is strange that Tritonias, Sparaxis and Babianas cannot be grown in the same way, though it is some consolation that they can be so easily grown in pots. To the undersigned Ixias are the most pleasing of all bulbs. He has thousands in bloom in the month of June, and thinks they make a braver show even than tulips. W. E. ENDICOTT.


1188. Ixia paniculata (× ⅓).

CULTURE OF IXIAS IN GREENHOUSES.—Ixia bulbs can be planted any time from September 15 to October 30, the sooner the better. In general, tender bulbs of small size tend to lose vitality when kept a long time in the dry air of warehouses. Ixia bulbs should be planted an inch deep, 5 or 6 in a 5-in. pot, or 8 to 10 in a 6-in. pot. They like a compound of sandy soil and leaf-mold. It is supposed that three-fourths of the failures with Ixias are due to hasty forcing. The pots should be stored under a bench or in a rather dark cellar, at a temperature of 45°. The object is to hold back the tops while the roots are growing, in order to get stocky, well colored, slowly started shoots. They need no water until growth has started. Then water carefully until the flowers come, as the young plants are liable to rot at the surface of the ground. While flowering water freely. After flowering, some gardeners give the plants no water. Others keep the soil moist until the leaves turn yellow, and then gradually withhold water. As to temperature, the plants may be brought into a cool greenhouse (50°) when well started, and towards the end of January may be given 5° more heat if flowers are desired as early as the middle of March. Ixias have to be staked and tied. The old bulbs, from which the offsets have been removed, may be used again. Ixia bulbs, which are really fibrous-coated corms about ⅜ in. thick, keep as well as Freesias. Seedlings flower the third year. W. M.


1189. Ixia maculata. (× ½.)

CULTURE OF IXIAS IN COLDFRAMES.—Choose for the frame an open place, sheltered from north and west winds. In its construction give especial care to providing good drainage, to close-fitting and snug banking, so that frost, mice and moles can be kept out. A sandy soil, without manures, is safest and best for Ixias. If fertilizers are used they must be placed several inches below the bulbs, never in contact with them. As in outdoor culture, the bulbs must be planted late and in soil well dried by placing the sashes over the frame some time beforehand. Plant about 3 inches deep, as far apart, and treat afterwards much as in greenhouse culture. Take off the sashes in early May to show the mass of rich, odd flowers which, ordinarily, will open about that time and last for several weeks. If the frame is to have other tenants through the summer, the Ixias may be taken up after their tops are dead and stored in dry sand till planting time comes around again. Otherwise, merely cease watering as the tops of the Ixias die down, and put on the sashes again, tilting them so that they will give air and shed rain. L. GREENLEE.

INDEX.

aristata, 3.
columellaris, 10.
craterioides, 8.
flexuosa, 5.
longiflora, 2.
lutea, 6.
maculata, 9.
monadelpha, 13.
odorata, 1.
ovata, 11.
paniculata, 2.
patens, 7.
polystachya, 4.
speciosa, 8.
viridiflora, 12.

A. *Tube of perianth dilated below the limb into a distinct funnel.*

1. **odoràta**, Ker. Fls. pure yellow. B.M. 1173.

AA. *Tube of perianth not dilated.*

B. *Length of tube 2½–3 in.*

2. **paniculàta**, Delaroche (*I. longiflòra*, Berg.). Fig. 1188. Segments white, often tinged red: throat same color or black. B.M. 256 and 1502.

BB. *Length of tube 1 in.*

3. **aristàta**, Ker. Fls. whitish, according to Baker, but a fine pink in B.M. 589.

BBB. *Length of tube ½–¾ in.*

C. *Segments ½ in. long or less.*

D. *Color white.*

4. **polystàchya**, Linn. No eye. B.M. 623.

DD. *Color shades of red or lilac.*

5. **flexuòsa**, Linn. No eye. B.M. 624.

CC. *Segments more than ½ in. long.*

D. *Fls. self-colored.*

E. *Color yellow or orange.*

6. **lùtea**, Baker. Fls. "uniformly deep bright yellow," according to Baker, but orange in B.M. 846.

EE. *Color red.*

F. *Segments ½–¾ in. long.*

7. **pàtens**, Ait. Fls. pale red, according to Baker, but deep rosy red in B. M. 522.

FF. *Segments ¾–1 in. long.*

8. **speciòsa**, Andr. (*I. craterioides*, Ker.). Fls. dark crimson, according to Baker, but rich ruby-red in B.M. 594.

DD. *Fls. with an eye of brown, purple or black.*

E. *Color of segments white to yellow.*

9. **maculàta**, Linn. Fig. 1189. Fls. typically yellow, according to Baker. B.M. 539 (orange). The following natural varieties show the range of color. Var. **ochroleùca**, Ker. Segments sulfur-yellow; eye brown. B.M. 1285. Var. **nigro-álbida**, Klatt. Segments white; eye black. Var. **ornàta**, Baker. Fls. flushed bright red or purple outside.

EE. *Color of segments lilac to purple.*

10. **columellàris**, Ker. Typically with bright, mauve-purple segments and blue throat. B.M. 630.

EEE. *Color of segments bright red.*

11. **ovàta**, Klatt. Andrews Bot. Rep., plate 23.

EEEE. *Color of segments green.*

12. **viridiflòra**, Lam. Typically with pale green segments and black throat. B.M. 549. L.B.C. 16:1548. F.S. 2:124. Var. **càna**, Eckl. Segments pale blue; throat black. B.M. 789 (as *I. maculata amethystina*). Var. **cæsia**, Ker. Segments pale lilac; eye greenish. B.R. 7:530.

EEEEE. *Color of segments pale blue.*

13. **monadélpha**, Delaroche. Only species in the genus that does not have free anthers. B.M. 607; 1378.—Segments typically lilac, but there are forms with claret-red, blue or pale yellow segments, combined with eyes and markings of various colors. W. M.

IXIOLÍRION (Greek, *an Ixia-like lily*). *Amaryllidàceæ*. A genus of 2 species of hardy bulbs from western Asia, with umbels of 5–9 deep blue or violet, 6-lobed fls. each 2 in. across, borne in spring. Perianth regular, without any tube above the ovary; segments oblanceolate; stamens shorter than the segments, attached to their claws. The nearest cultivated allies are Alstrœmeria and Bomarea, which have no distinct rootstock, while Ixiolirion has a bulbous rootstock. Monogr. by Baker, Amaryllideæ, 1888.

montànum, Herb. (*I. Pállasii*, Fisch. & Mey.). Bulb ovoid, 1 in. thick, with a neck 2–3 in. below the basal tuft of lvs.: stem about 1 ft. loug: lvs. about 4, persistent, and a few smaller ones above: fls. on long unequal pedicels and often 1 or 2 fls. below; perianth bright lilac according to Baker. Syria to Siberia. B.R. 30:66. F.S. 22:2270. R.H. 1880:310. J.H. III. 31:583.

Var. **Tatáricum**, Herb. (*I. Tatáricum*, Hort.). Stems more slender: lvs. awl-shaped: fls. all in a terminal umbel, smaller than the type. Altai Mts. G.C. II. 19:757. Regel calls the collective species *I. Tataricum*, and describes 5 species of it.

IXÒRA (a Malabar deity). *Rubiàceæ*. Many species (100 or more) of shrubs or small trees with opposite or verticillate lvs. and terminal or axillary corymbs of very showy fls., inhabiting the tropical parts of Asia, Africa, America, Australia and Pacific islands. The species are very difficult to distinguish. The fls. are white, rose or scarlet, on bracteate pedicels; corolla very long- and slender-tubed, the throat sometimes barbed, the limb 4- or 5-lobed and wide-spreading; stamens 4 or 5, inserted on the throat, the filaments short or none: ovary on a fleshy disk, 2-loculed, the style filiform and exserted, 2-branched: ovules solitary. L. H. B.

Ixoras, which are handsome dwarf flowering shrubs, belong to the tropics. The species, as well as their hybrids, all bear beautiful trusses of flowers of various shades, from a creamy white to a rich crimson. They require a stove temperature during most of the time, although, after having finished their growth in the early autumn, they could be placed for a time into a lower or greenhouse temperature, in which they would more fully ripen their young growth and set and develop their flower buds. After this, when again placed in the warmhouse, the plants will keep flowering until spring. Sandy leaf-mold, with plenty of drainage, is best to cultivate them in. They like plenty of heat and moisture, and care should be taken not to overpot them. The foliage should be syringed often, as otherwise the mealy bug and other insects will infest them. They do best in a sunny spot in a greenhouse temperature, but should not fall below 60° while growing. They propagate freely from cuttings of half-ripe wood, and they produce their best flowers when the pots are filled with roots; then a little feeding with liquid manure will bring out the size and color of the flowers to perfection. H. A. SIEBRECHT.

Many of the Latin names of Ixoras are of horticultural forms. Of this class, the following are in the Amer. trade: *Chélsoni*, fls. brilliant salmon-orange. *Còlei*, fls. pure white: cross of *I. coccinea* and *I. stricta*, var. *alba*. *Conspícua*, fls. yellow, becoming orange. *Dixiàna*, fls. deep orange. *Fràseri*, fls. scarlet in the tube, and brilliant salmon above. *Ornàta*, salmon-orange. *Princeps*, fls. whitish, becoming orange; said to have come from Java. *Regìna*, fls. shaded violet-salmon. *Sanguínea*, fls. crimson, shaded with violet. *Spléndida*, crimson-orange. I.H. 29:463. *Wéstii*, fls. pale rose, becoming brilliant; hybrid (Gn. 42:886. G.M. 36:35). *Williamsii*, fls. reddish salmon. Other horticultural forms are: *Armenìaca*, yellow; *Décora*, yellow; *Illùstris*, orange; *Insígnis*, rose; *Pílgrimi*, orange-scarlet; *Profùsa*, rose; *Speciòsa*, yellow; *Spléndens*, orange; *Venùsta*, orange.

A. *Fls. usually in shades of red (sometimes varying to rose).*

stricta, Roxbg. (*I. coccínea*, Hort. *I. blánda*, Ker. *I. crocàta*, Lindl.). Apparently the common species, known in greenhouses as *I. coccinea:* glabrous shrub, with sessile or subsessile lvs. which are obovate or obovate oblong, and very slender-tubed fls. in dense corymbs, the corolla lobes short and rounded. Moluccas and China. B.M. 169 (as *I. coccinea*). B.R. 10:782.—Runs into nearly pure white forms. *I. striata* of the importers of Japanese plants is probably a misprint for *stricta*. There are said to be yellowish fld. forms. Prince of Orange is said to be a form of this species.

coccínea, Linn. (*I. grandiflòra*, Br. *I. Bandhúca*, Roxbg.). Much like the last, but lvs. oblong and corolla lobes acute. E. Indies. B.R. 2:154; 6:513.

macrothýrsa, Tejsm. & Binn. (*I. Dúffii*, Moore). Very large, glabrous: lvs. a foot long, linear-oblong to oblong-lanceolate: cluster very large, 8 in. across, bearing very many deep red tinged crimson fls., with lanceolate obtuse lobes about ½ in. long. E. Indies. B. M. 6853.—Probably the finest of the genus.

AA. *Fls. in shades of yellow or orange.*

Javánica, DC. Glabrous shrub with lvs. 5–7 in. long, ovate-oblong, acute or acuminate: corymb terminal, with forking coral-red branches: fls. deep orange-red, the lobes rounded. Java. B.M. 4586.

congésta, Roxb. (*I. Griffithii*, Hook.). Evergreen tree in its native haunts, glabrous, except the cymes: lvs. very large (6–12 in. long), stalked, elliptic or elliptic-oblong, acute or acuminate: cymes sessile or nearly so: fls. orange-yellow, changing to reddish, the segments rounded. Indies. B.M. 4325.

AAA. *Flowers white.*

parviflòra, Vahl. Evergreen tree, with subsessile oblong or elliptic-obtuse lvs. 3–6 in. long: cymes sessile: fls. white, the tube only ½ in. long. India. L. H. B.

J

JACARÁNDA (Brazilian name). *Bignoniàceæ. J. ovalifolia* perhaps ranks among the 100 best flowering trees or shrubs for subtropical regions. The foliage is as finely cut as a fern, symmetrical and elegant. The leaves are decussate, distant, each one with 16 or more pairs of pinnæ, each pinna having 14–24 pairs of leaflets. The plant bears loose, pyramidal panicles, 8 in. high, of 40–90 blue fls., each 2 in. long and 1½ in. wide, which have a long, bent, swelling tube and the 2 lobes of one lip smaller than the 3 other lobes. From S. Fla. It is one of the best of foliage plants for the S., valuable alike for florists' decorations, conservatory, subtropical bedding in the North, or for lawn specimens in Florida, where, if cut back by frost, it rapidly recovers its beauty. It reaches a height of 20 ft. or more. It is commonly planted in parts of S. Calif., and attains a height of 50 ft. and more. This species is also cult. in Europe under glass. Jacaranda is a genus of about 30 tropical American species, mostly Brazilian: trees, with lvs. opposite, 2-pinnate, rarely 1-pinnate: lfts. usually numerous, entire or dentate: fls. showy blue or violet, panicled; corolla lobes rotund; perfect stamens 4, didynamous; staminode about as long as the stamens, club-shaped at the apex and often bearded at the top.

ovalifòlia, R. Br. (*J. mimosæfòlia*, D. Don). Lvs. distant, spreading, oblong, villous: fls. more or less horizontal. S. Amer. B.R. 8:631. B.M. 2327. R.H. 1897:132.

E. N. REASONER and W M.

JACK BEAN. Refer to *Canavalia*.

JACK FRUIT. *Artocarpus integrifolia*.

JACK-IN-A-BOX. *Hernandia*.

JACK-IN-THE-PULPIT. See *Arisæma*.

JACOBÆA. All included in *Senecio*.

JACOBÍNIA (probably a personal name). *Acanthàceæ*. A polymorphous genus of 30 or 40 tropical American herbs or shrubs, including the genera Libonia, Sericographis and Cyrtanthera. Plants cultivated for their narrow-tubular red, orange or yellow fls.: lvs. opposite and entire: calyx deeply 5-parted, with linear or awl-shaped segments; corolla more or less 2-lipped, one lip 2-lobed and the other 3-lobed; stamens 2; staminodia represented by two hairy elevations on the corolla tube; pistil ripening into an oblong or ovate capsule, the style filiform, the ovary surrounded by a disk.

Jacobinias, in common with other Acanthads, are much confused as to species. A closely allied genus is Justicia, which, among other characters, is distinguished by having spurs or appendages at the base of the anther lobes, whereas Jacobinia has no such appendages. Other allied genera are Aphelandra, Dianthera, Adhatoda, Thyrsacanthus, Eranthemum, Barleria, Dædalacanthus.

Jacobinias are mostly subshrubs in their native places, but they are usually treated as herbs under cultivation. They are showy greenhouse or conservatory subjects. When well grown they are attractive plants, but they soon become weedy under neglect. They propagate very readily from cuttings, after the manner of fuchsias, and the most satisfactory plants are usually those which are allowed to bloom but once. Most of them thrive well under conditions suited to begonias.

A. *Fls. in a more or less dense terminal panicle or thyrse: corolla long, more or less curved: stamens fixed to the middle or near the top of corolla tube. (Subgenus Cyrtanthera.)*

magnifica, Benth. & Hook. (*Cyrtanthèra magnifica*, Nees. *Justicia magnifica*, Pohl). Strong forking herb or subshrub, blooming when 1 or 2 ft. high, but becoming several feet high if allowed to grow: stems 4-angled: lvs. opposite, lanceolate to ovate-lanceolate to oval-oblong, narrow or broad at base, attenuate to apex, wavy-margined, veiny, downy, sometimes a foot long: fls. rose-purple, ascending, arched at the top and the lower lip recurving, borne in dense terminal spike-like thyrses. Brazil. G.F. 5:317. Var. **cárnea** (*Justicia cárnea*, Hook.) has flesh-colored fls. B.M. 3383. B.R. 17:1397.—A handsome old plant, of comparatively easy culture in a conservatory temperature. Cuttings made in Feb. or March should bloom early the following winter. Young plants are usually most satisfactory, the old ones being kept over only for cutting stock. Give rich soil, and plenty of water in the growing season.

Pohliàna, Benth. & Hook. (*Cyrtanthèra Pohliàna*, Nees). Much like *J. magnifica*, but more robust and leafy: lvs. ovate-acuminate and rounded or nearly or quite cordate at the base, more glabrous, often purple-tinged: fls. bright crimson: bracts short-acute, or in one form obtuse. Brazil.—Voss considers *J. magnifica*, var. *carnea* to be synonymous with *J. Pohliana*.

Var. **velùtina**, Hort. (*J. velùtina* and *Justicia velùtina*, Hort. *Cyrtanthèra Pohliàna*, var *velùtina*, Nees). Dwarf: bracts obtuse: lvs. villous-pubescent on both surfaces: fls. 2 in. long, rose-color. Brazil. Gng. 7:212. A.F 14:998.—A worthy plant of comparatively recent introduction in this country. It is an excellent pot subject and has been considerably advertised recently as the "New Dwarf *Justicia velutina*." A profuse and continuous bloomer. Cultural remarks under *J. magnifica* also apply to this.

AA. *Fls. in a dense terminal spike: corolla long and curved: stamens fixed to the base of the tube. (Subgenus Polystachys.)*

coccínea, Hiern. (*Justicia coccínea*, Aubl.). Erect herb or subshrub, usually grown from cuttings each year and treated as a pot subject: 2–5 ft. high: branches terete: lvs. elliptic or ovate-lanceolate, entire, glabrous or nearly so: fls. crimson, in a dense terminal spike, pubescent, the long upper lip more or less arched and the lower one reflexed. Brazil. B.M. 432.—Blooms in summer. Said to be known sometimes as *Aphelandra cristata*.

1190. Jacobinia Penrhosiensis (× ½).

AAA. *Fls. scattered or in loose more or less leafy panicles: of medium length, straight or nearly so, not deeply cleft. (Subgenus Libonia.)*

paucifldra, Benth. & Hook. (*Sericógraphis pauciflòra*, Nees. *Libònia floribúnda*, C. Koch). A common conservatory plant, subshrubby, but usually treated as a pot-plant, with terete, short-jointed, close pubescent branches: lvs. elliptic or elliptic-oblong, short and rather small, entire, very short-stalked: fls. 1 in. long, tubular, drooping or nearly horizontal, scarlet with yellow at the end, the lips short. Brazil.—A most floriferous plant, almost as easy to grow as a fuchsia, and to be handled in essentially the same way.

Penrhosiénsis (*Libònia Penrhosiénsis*, Carr.). Fig. 1190. Much like the last, but lvs. more pointed and fls. larger and more showy. R.H. 1876:50. Gng. 2:131.—It is a most excellent plant, and is taking the place of *J. pauciflora*. It is hybrid of *J. pauciflora* and *J. Ghiesbrechtiana*. Another and very similar hybrid of the same parentage is *Sericobònia ignea*, Lindl. & André. I.H. 22:198. *J. Penrhosiensis* is a winter bloomer, a little earlier than *J. pauciflora*. Cuttings struck in spring make full blooming subjects by fall and early winter. This and *J. pauciflora* are common conservatory plants.

Ghiesbreghtiàna, Benth. & Hook. (*Cyrtanthèra Ghiesbreghtiana*, Decne. *Sericógraphis Ghiesbreghtiàna*, Nees. *Justicia Gheisbreghtiàna*, Lem. *Apheléndra Ghiesbreghtiàna*, Hort.). Lvs. narrower (lance-ovate) and longer, acuminate: fls. in a terminal, very loose panicle, tubular, scarlet, appearing at the same season as those of *J. Penrhosiensis*. Mex. F.S. 4:339.—Introd. by Ghiesbreght; but when the plant was transferred to the genus Jacobinia the name was misspelled *Ghiesbrechtiana*.

J. Lindeni, Nichols. (Justicia Lindeni, Houll.), is a Mexican subshrub, with lance-ovate lvs., and a fascicled head of orange-yellow fls. Does not appear to be in the Amer. trade. R.H. 1870:250.

L. H. B.

JACOB'S LADDER. *Polemonium cæruleum.*

JACOB'S STAFF. *Fouquieria splendens.*

JACQUEMÓNTIA (after Victor Jacquemont, a French naturalist; died 1832). *Convolvulàceæ.* About 50 species of tropical and subtropical twining herbs, allied to Ipomœa and Convolvulus, to which they are inferior for garden culture. They are distinguished from Ipomœa by having two stigmas instead of one; and from Convolvulus by having the stigmas ovate or oblong instead of linear-filiform to subulate. *I. violacea* makes an attractive greenhouse climber for summer and autumn flowering, but is not as desirable for this purpose as several species of Ipomœa. It is apt to become leggy after a few years. Propagated readily by seeds or cuttings. For other botanical characters and cultural directions, see *Ipomœa.*

violàcea, Choisy (*Convólvulus pentánthus*, Jacq.). Stem perennial, somewhat shrubby at base, twining 6–8 ft., pubescent or nearly glabrous: lvs. cordate to ovate-lanceolate, acuminate: peduncles slender, bearing 5–12 fls. in a loose cymose cluster: corolla about 1¼ in. wide, short-funnelform, sharply 5-angled, rich violet-blue. June–Sept. Trop. Amer., and as far north as Fla. B.M. 2151. B. 4:197. P.M. 6:219. In var. **canéscens**, Hort. (*J. canéscens*, Benth.), the whole plant is covered with short, brownish down. B.R. 33:27.

tamnifòlia, Griseb. Plant annual, usually low and erect, at length twining if support is near, covered with tawny yellow hairs: lvs. cordate, ovate, long-petioled: peduncles bearing many fls. in dense, involucrate clusters: fls. less than ½ in. long, violet. Cult. and waste ground, S. C. to Ark., and southward.

S. W. Fletcher.

JACQUÍNIA (Nicholas Joseph de Jacquin, 1727–1817, distinguished botanical painter and writer, who painted many West Indian plants from nature). *Myrsinàceæ.* About 20 species of tropical American trees and shrubs, one of which is called Bracelet Wood in the West Indies, because the brown and yellow shiny seeds are made into bracelets. It is a low tree, with evergreen lvs. somewhat like box but obovate, and racemes of small, white, honey-scented fls. which in the North under glass would be borne in winter. It seems to be cult. only in S. Fla. and S. Calif. outdoors. Generic characters are lvs. rigid, margined, entire: fls. white or orange, borne in racemes, umbels or singly; corolla 5-fid, wheel- to salver-shaped, crowned at the throat and between the lobes with 5 roundish appendages (staminodia): berry leathery, several-seeded. In the allied genus Theophrasta the corolla is cylidrical, shortly 5-lobed, the appendages are fastened at the base of the corolla instead of the throat, and the berry is many-seeded.

armillàris, Linn. Lvs. cuneate-spatulate or obovate, blunt, revolute at the margin, usually whorled, 4 in. long, 1½ in. wide: berry ¼ in. thick. W. Indies.

JAMBOLAN. *Eugenia Jambolana.*

JAMBOS. See *Eugenia Jambos.*

JAMÈSIA (after its discoverer, Dr. Edwin James, 1797–1861, botanical explorer of the Rocky Mountains). Syn., *Edwinia. Saxifragàceæ.* Low, hardy shrub of upright habit, with deciduous, opposite, petioled, serrate lvs., and white fls. in terminal, short panicles. Handsome shrub for borders of shrubberies or rocky slopes in sunny situations, thriving in any well drained garden soil, best in a peaty and sandy one. Prop. by seeds or by cuttings of ripened wood. One species in the Rocky Mountains from Utah to New Mex. Lvs. without stipules: calyx lobes and petals 5: stamens 10: styles usually 3: fr. a 3-celled, many-seeded, dehiscent capsule.

Americàna, Torr. & Gr. Shrub, to 4 ft.: lvs. broadly ovate to oblong-ovate, acute, serrate, dentate, pubescent or almost glabrous above, whitish tomentose beneath, ½–2 in. long: fls. about ½ in. across, white, sometimes pinkish outside. June. B.M. 6142. J.H. III. 32:37. Gn. 32, p. 522, and 33, p. 606.

Alfred Rehder.

JAMESTOWN WEED is *Datura Stramonium.*

JAMROSADE. See *Eugenia Jambos.*

JARRAH. *Eucalyptus marginata.*

JASIÒNE (ancient name of no application to this plant). *Campanulàceæ.* This includes the Shepherd's Scabious, a hardy herbaceous perennial plant of compact habit, about a foot high, and bearing globose heads 2 inches in diameter, composed of very many light blue flowers. It is of easy culture in any garden soil, grows either in full sunlight or partial shade, and is equally adapted for borders, edgings, or the rockery. The common annual Scabious belongs to the teasel family, and has 4 stamens, while the Shepherd's Scabious has 5 stamens. Jasione has about 12 species, mostly European, and is easily distinguished from its allies by the fls. being borne in a head with an involucre, the corolla cut into 5 awl-shaped strips, and the anthers somewhat united at their bases. They differ widely in duration and habit. Prop. by division and seed.

perénnis, Lam. Shepherd's Scabious. Sheep Scabious. Sheep's-bit. Stem erect, sparingly if at all branched: root-lvs. obovate, in the non-floriferous plants forming a tufted rosette; stem-lvs. oblong-linear, entire: peduncles long, leafless: bracts ovate, serrate-dentate. July, Aug. B.R. 6:505. B.M. 2198.

J. B. Keller and W. M.

JÁSMINUM (Arabic name). *Oleàceæ.* Jasmine. Jessamine. Climbing or erect shrubs, of more than 100 species in warm regions of the Old World. Fls. fragrant; corolla yellow or white (sometimes reddish outside), salver-shaped, the 4–9 lobes convolute in the bud, much exceeding the calyx; stamens 2, included in the corolla tube: ovary 2-loculed, with a single erect ovule in each locule, becoming in fr. a twin berry: lvs. pinnate, but sometimes reduced to 1 lft. (petiole jointed). Jasmines are of diverse horticultural groups. Some of them are hardy in the middle and southern states, whereas others are winter-flowering warmhouse plants. Most of them are known as coolhouse or temperate-house shrubs, of half-climbing habit. They are all of easy culture. They propagate readily by cuttings of nearly mature wood and by layers. Often the fls. are very fragrant. The species are usually called Jasmines, and the word Jessamine is commonly restricted to *J. officinale*, which is the Jessamine of poetry. Some of them (particularly *J. grandiflorum*) are grown for perfume-making. The Cape Jessamine is Gardenia. Yellow or Carolina Jessamine is Gelsemium.

INDEX.

affine, 7.
anastomosans, 5.
Azoricum, 9.
flavum, 10.
gracile, 6.
gracillimum, 4.
grandiflorum, 8.
hirsutum, 3.
humile, 10.
lucidum, 6.
multiflorum, 3.
nudiflorum, 12.
odoratissimum, 11.
officinale, 7.
poeticum, 7.
pubescens, 3.
Reevesii, 10.
revolutum, 10.
Sambac, 1.
Sieboldianum, 12.
simplicifolium, 6.
trifoliatum, 1.
trinerve, 5.
triumphans, 10.
undulatum, 2.

A. *Lvs. reduced to one lft.: fls. white.*

B. *Calyx pubescent or hairy.*

1. **Sámbac**, Soland. ARABIAN JASMINE. Climbing, the angular branchlets pubescent: lvs. opposite or ternate (the ternate-lvd. specimens giving rise to the name *trifoliatum*), firm in texture, shining, nearly or quite glabrous, the petiole short and abruptly curved upwards, elliptic-ovate or broad-ovate, either prominently acute or completely rounded on the end, entire, prominently veined: clusters 3–12-fld.: calyx lobes linear and prominent, hirsute on the edges (sometimes almost glabrous): corolla tube ½ in. long; lobes oblong or orbicular. India.—Much cult. in the tropics. Fls. white, but turning purple as they die. B.R. 1:1. A full double button-fld. group is in cult., one form of which is the Grand Duke of Tuscany (or Grand Duke). The double form is shown in B.M. 1785. This double form sometimes passes as *J. trifoliatum*. *J. Sambac* is a perpetual bloomer, particularly in frostless countries, where it can stand in the open.

2. **undulàtum**, Ker. Climbing, with hairy branches. slender: lvs. opposite, short-petioled, rather small (about 2 in. long), ovate-lanceolate and acuminate, somewhat pubescent beneath, somewhat undulate: fls. 6–10, in terminal cymes, white, long-tubed; calyx teeth short; corolla tube ¾ in. long, and slender; lobes half or less as long, acute. India. B.R. 6:436.—Lvs. sometimes ternate. Little known in cult. in this country.

3. **pubéscens**, Willd. (*J. hirsùtum*, Willd. *J. multiflòrum*, Andr.). Climbing, rusty-hairy: lvs. very short-petioled, rather thick, ovate-acute: calyx teeth usually ⅔ in. long (nearly or quite twice as long as in *J. undulatum*), with spreading yellow hairs: fls. white, much like those of *J. undulatum*, the lobes broad, often half-double. India. B.M. 1991. B.R. 1:15.—Will stand some frost.

4. **gracíllimum**, Hook. f. Climbing or scrambling, soft pubescent or hairy: lvs. very short-petioled, ovate-lanceolate, acuminate, the base cordate or truncate, bright green above and pubescent beneath, 1½ in. or less long: fls. white, in very large, dense hanging heads, an inch or more across, fragrant; calyx teeth long and awl-like, half as long as the slender corolla tube; corolla lobes many (usually about 9), acute. N. Borneo. G.C. II. 15:9. B.M. 6559.—Long, lithe branches spring from near the ground and bear heavy clusters at their ends. Handsome winter bloomer. Nearly hardy in eastern N. Car.

BB. *Calyx glabrous.*

5. **trinérve**, Vahl. Tall-climbing, with terete glabrous branches: lvs. short-stalked, ample, ovate-oblong and acuminate, strongly 3-nerved from the base: fls. white, in small clusters; calyx teeth narrow but much shorter than the long corolla tube; corolla lobes only half as long as the tube, acute. India. B.R. 11:918.—Perhaps only a form of *J. anastomosans*, Wall.

6. **simplicifòlium**, Forst. (*J. lùcidum*, Banks). Climber, or sometimes a tree in its native place, glabrous or pubescent: lvs. mostly short-stalked, shining, varying from oblong-elliptic to ovate-lanceolate to cordate-ovate, acute or obtuse, usually less than 3 in. long: fls. white, in terminal forking, many-fld. clusters; calyx teeth short and sometimes scarcely any; corolla tube ⅓–½ in. long, the acute lobes somewhat shorter. Austral. B.M. 980. B.R. 8:606 (as *J. gracile*, Andr.).—Summer bloomer.

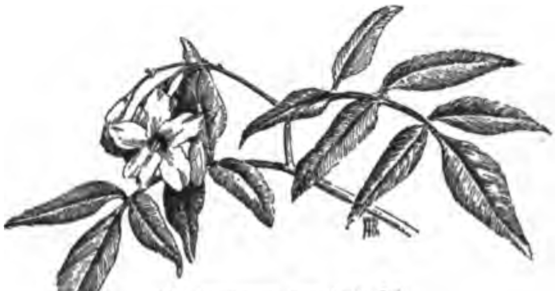
AA. *Lvs. of 3 or more lfts.*

B. *Flowers white.*

7. **officinàle**, Linn. (*J. poéticum*, Hort.). JESSAMINE. Long, slender grower requiring support, but scarcely self-climbing, glabrous or very nearly so: lvs. opposite, odd-pinnate, the lateral lfts. 2–3 pairs and rhomboid-oblong-acute, the terminal one longer: fls. 2–10 in terminal more or less leafy clusters; calyx teeth linear, ¼–⅜ in. long, or sometimes as long as the rather short corolla tube; corolla lobes oblong, more or less involute on the margins. Persia, India. B.M. 31. R.H. 1878, p. 428.—Long cultivated. The glossy foliage and fragrant white summer-blooming fls. render the plant very attractive in the S., where it is hardy. With protection it will stand as far N. as Phila. Var. **affine**, Nichols. (*J. affine*, Hort.), is a form with larger fls. R.H. 1878, p. 428.

8. **grandiflòrum**, Linn. CATALONIAN, ITALIAN, ROYAL or SPANISH JASMINE. Nearly erect-growing, the branches drooping and angular, glabrous or very nearly so: lvs. opposite, the rachis flattened or winged, the lfts. 2–3 pairs, elliptic or round-elliptic, mostly ending in a very small point or cusp: calyx teeth ¼ in. long or rarely half as long as the corolla tube; corolla star-shaped, larger than in *J. officinale*. India. B.R. 2:91.—Probably the best white-flowered species. Summer and fall, or nearly perpetual in warm countries. Much grown in Eu. for perfumery. Stands 10°–12° of frost.

9. **Azòricum**, Linn. Climbing, glabrous or nearly so, the branches terete: lvs. evergreen, opposite, the lfts. 3, ovate-acuminate, the 2 side ones often smaller: calyx teeth very small; oblong corolla lobes about as long as the tube. Canary Isl. B.M. 1889.—A good white-fld. temperate-house species blooming in summer and winter.



1191. Jasminum humile (× ⅓).

BB. *Flowers yellow.*

10. **hùmile**, Linn. (*J. revolùtum*, Sims. *J. flàvum*, Sieb. *J. triúmphans*, Hort.). ITALIAN YELLOW JASMINE. Fig. 1191. A diffuse shrub, in the open ground in the S. reaching 20 ft. and requiring support, but in glasshouses usually grown as a pot bush: branches glabrous, angled: lvs. alternate, odd-pinnate (rarely reduced to 1 lft.), the lateral lfts. 1–3 pairs, all lfts. thickish and acuminate, and more or less revolute on the edges, varying from oblong to oblong-lanceolate to oblong-rotund: fls. bright yellow, in open clusters; calyx teeth very short; corolla tube ¾–1 in. long, usually considerably exceeding the mostly obtuse and reflexing lobes. Trop. Asia. B.M. 1731. B.R. 3:178; 5:350. L.B.C. 10:966.—The commonest Jasmine in American glasshouses, usually known as *J. revolutum*. It is hardy in the open as far north as Maryland. Lvs. thick and evergreen. Needs a cool house if grown under glass. Summer and fall bloomer. *J. Reèvesii*, Hort., may belong to this species.

11. **odoratíssimum**, Linn. Much like the last, but more erect and less leafy when in flower: lvs. alternate, the leaflets 3 or 5, shining, oval or broad-oval and obtuse: fls. yellow, in a terminal cluster; calyx teeth very short; corolla lobes oblong-obtuse, mostly shorter than the tube.

Summer. Madeira. B.M. 285.—It is an erect, glabrous shrub with straight, stiff, terete or faintly angular branches.

12. **nudiflòrum**, Lindl. (*J. Sieboldiànum*, Blume). Twiggy, nearly erect shrub with 4-angled glabrous stiff branchlets: lvs. opposite, small, with 3 little ovate ciliate lfts., the entire foliage falling in autumn or when the growth is completed: fls. solitary, in early spring (or winter), from long, scaly buds, subtended by several or many small leaf-like bracts, yellow; calyx lobes leafy and spreading or reflexed, shorter than the corolla tube; corolla segments obovate, often wavy. China. B.R. 32:48. B.M. 4649. R.H. 1852:201. G.C. III. 11:181.—A most interesting plant, reminding one of Forsythia when in bloom. Hardy south of Washington, and blooming nearly all winter. With protection, it will stand as far north as Hudson river valley, and bloom very early in spring. In northern glasshouses, used mostly as a late winter and early spring bloomer. Strong-growing specimens need support.

J. angulàre, Vahl. Fls. very long-tubed, white: lvs. opposite, ternate. S. Afr. B.M. 6865.—*J. calcàreum*, Muell. (J. Novæ Zelandicum, Bosse), is a spring- and summer-blooming Australian species with white fls. and simple, opposite, thick, 3- or 5-nerved lvs.—*J. didymum*, Forst. Climber: fls. small, white, in narrow axillary cymes which exceed the lvs.: lvs. opposite, ternate; lfts. often retuse. Austral. B.M. 6349.—*J. frùticans*, Linn. Bushy: branches angular: lvs. alternate, small, ternate, the lfts. obovate: fls. yellow. Mediterranean region. B.M. 461.—*J. polyánthum*, Franch., a recent Chinese species in the way of J. grandiflorum, may be expected to appear in cult. Fls. white inside, reddish outside, long-tubed: lvs. opposite, with about 5 long-acuminate lfts. R.H. 1891, p. 270.—*J. pubigerum*, Don. Much like J. humile, but fls. smaller and plant villous. India.

L. H. B.

JÁTROPHA (Greek, referring to its medicinal use). *Euphorbiàceæ*. This includes the French Physic Nut, *J. Curcas*, which is grown commercially in the Cape Verde Islands for the seeds, which yield a purgative oil resembling castor oil. It is also grown for ornament in S. Fla. and S. Calif. About 68 species of tropical herbs or tall shrubs: lvs. alternate, petiolate, usually palmately lobed: fls. at the tips of branches in forking cymose panicles, monœcious; calyx 5-parted; corolla twisted; stamens 10 or fewer: column surrounded by 5 glands: capsule 2–3-seeded.

multífida, Linn. Shrubby, 5–10 ft. high: lvs. long-petioled, 7–9-parted, glabrous, not glandular; segments pinnatifid; stipules many-parted, the divisions bristly: cymes umbel-like: petals distinct, 3 times as long as the calyx; stamens 8–10. Tropics; naturalized in Jamaica and common there.—Cult. at Santa Barbara, by Franceschi, who says its curiously divided leaves and scarlet flowers are very ornamental, and adds that it is called "Coral Bush."

Cúrcas, Linn. FRENCH PHYSIC NUT. Subshrub, 6–12 ft. high: lvs. subcordate-roundish, angular or obsoletely 3–5-lobed, glabrous; stipules deciduous: corolla 5-parted, villous inside, twice as long as the calyx; stamens 10–15. Tropics.—A weed at St. Vincent. Reasoner says it grows 20 ft. high.

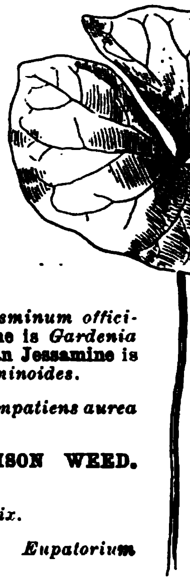
gossýpifolia, Linn. Subshrub, a few feet high: lvs. long-petioled, 5-parted, with prominent gland-tipped hairs on the margin, petioles and many-parted stipules, those on the petioles branched: petals distinct, dark purple; stamens 8–10. Tropics. L.B.C. 2:117. B.R. 9:746.—Long cultivated for ornament. Has been recently advocated as a specific for leprosy.

J. stimulòsa, Michx., the Spurge Nettle, is a common weed in the South.

J. B. S. NORTON.

JEFFERSÒNIA (after Thomas Jefferson, third president of the U. S.). *Berberidàceæ*. A genus of 2 species, one of which is a native hardy herbaceous perennial plant, growing about 8 in. high, with characteristic foliage and a naked scape, bearing a solitary white (sometimes reddish) flower in May. Distinguished from the group of cultivated allies mentioned under Epimedium by the following characters: lvs. 2-parted: sepals 4; petals 8, larger than the sepals, and flat; stamens 8: ovules in an indefinite number of series along the venter. The capsule is half-circumscissile near the top, making, with the scape, an object resembling a pipe. Mn. 5, p. 226.

binàta, Bart. (*J. diphýlla*, Pers.). Fig. 1192. Becoming 16–18 in. high in fruit: lvs. glaucous beneath, 3–6 in. long, 2–4 in. wide: fls. about 1 in. across. Woods, E. Pa. to Va. and Tenn. B.B. 2:92.



1192. Jeffersonia binata. Nat. size.

JERUSALEM ARTICHOKE. See *Artichoke, Jerusalem*. **J. Cherry.** *Solanum Pseudo-capsicum*. **J. Cross.** *Lychnis Chalcedonica*. **J. Oak.** *Chenopodium Botrys*. **J. Sage.** *Phlomis fruticosa*. **J. Thorn.** *Parkinsonia aculeata*.

JESSAMINE is *Jasminum officinale*. **Cape Jessamine** is *Gardenia jasminoides*. **Malayan Jessamine** is *Rhyncospermum jasminoides*.

JEWEL WEED. *Impatiens aurea* and *biflora*.

JIMPSON or JIMSON WEED. Consult *Datura*.

JOB'S TEARS. *Coix*.

JOE-PYE WEED. *Eupatorium purpureum*.

JOHNNY APPLESEED. See *Appleseed, Johnny*.

JOHNSON GRASS. *Andropogon Halepensis*.

JONQUIL. See *Narcissus*.

JOVE'S FRUIT. *Benzoin melissifolium*.

JUBÆA (after Juba, king of Numidia). *Palmàceæ*. This includes the Wine Palm of Chile, *J. spectabilis*, which in this country is cult. outdoors in S. Calif. and in the North under glass. "It is one of the hardiest palms," says Franceschi, "and can endure drought and many degrees of cold. If liberally treated, it makes a large tree in a few years." A full-sized trunk yields about 90 gallons of sugary sap, which is boiled by the Chileans and called palm honey. There is some danger of the species being exterminated in Chile. The fruits look like diminutive cocoanuts, and are called Coquitos, or by the trade "Monkey's Cocoanuts." In Europe, it is cult. under glass, and also used for subtropical bedding.

Jubæa spectabilis is a handsome and satisfactory palm for the cool palm house, where it would be treated in common with such plants as *Chamærops humilis*, the Sabals and *Euterpe montana*, which may be grown well in a night temperature of 50°, providing the plants are properly established. In general appearance, *J. spectabilis* reminds one of some kinds of Phœnix, and, like them, does not show the true character of its foliage in a very small state, the seedling Jubæa producing several simple lvs. before developing foliage of the pinnate type. In Jubæa, however, the lower pinnæ do not revert to spines, as is usually the case with Phœnix, and the pinnæ are also arranged irregularly on the midrib, thus giving the fronds a feathery effect. The culture of Jubæa is by no means difficult, propagation being effected by means of imported seeds, which usually give a fair percentage of germination, providing they are started in a warmhouse and kept moist. The seedlings should be potted as soon as the second leaf appears, and kept in a warmhouse until they are large enough for a 4-inch pot, and from this time forward cooler treatment will give the best results, always remembering the fact that while many palms (and Jubæa among the number), will bear much neglect, yet the best results are only to be had by giving plenty of nourishment.

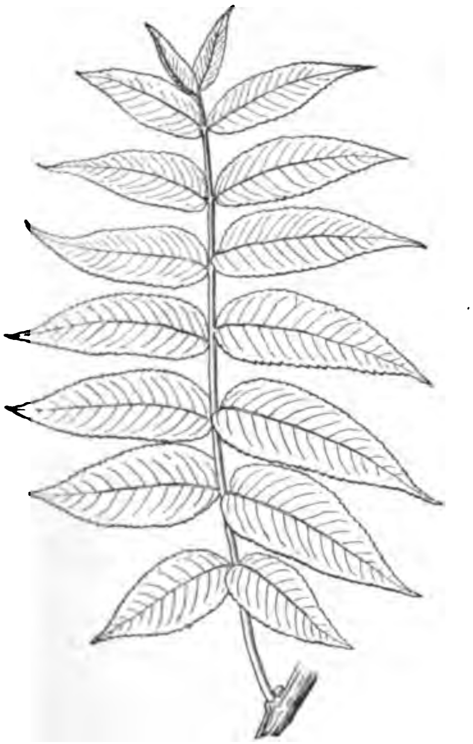
Jubæa has 2 species of tall, unarmed S. American palms: caudex thick, covered with the bases of the sheaths: lvs. terminal, pinnatisect; segments spreading, linear-lanceolate, rigid; margins recurved; rachis laterally compressed, convex on the back, acute beneath; sheath short, open. Allied genera in cult. are Attalea, Cocos, Maximiliana and Scheelea, which are distinguished chiefly by the staminate fls. In Jubæa the petals are lanceolate: stamens numerous, included, the anther cells connate: fr. 1-seeded. In Attalea the petals are lanceolate: stamens 10–24, included, anther cells connate: fr. 2–6-seeded. For distinctions from other genera consult, also, *Cocos*, *Maximiliana* and *Scheelea*.

spectábilis, HBK. Height 40–60 ft.: lvs. 6–12 ft. long. G.C. II. 18:401; III. 18:516. Gn. 5, p. 413. V. 8:340. —The southernmost American palm.

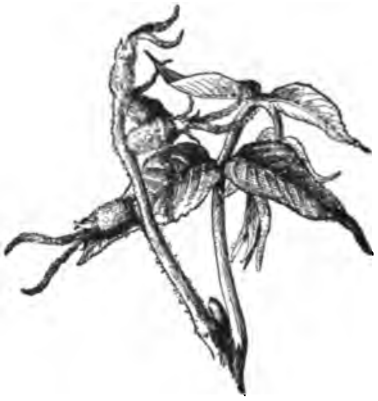
W. H. Taplin and W. M.

JUDAS TREE. *Cercis.*

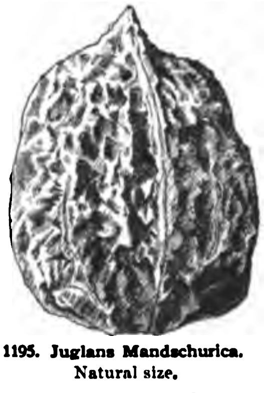
JÚGLANS (ancient Latin name from *Jovis glans*, nut of Jupiter). *Juglandàceæ.* Walnut. Butternut. Ornamental and fruit-bearing trees, rarely shrubs, with deciduous, alternate, odd-pinnate lvs., and with inconspicuous greenish fls., appearing with the lvs., the staminate in pendulous slender catkins, the pistillate in few- to many-fld. racemes: the fr. a large drupe, containing an edible nut. Most of the species are hardy, and are very valuable park trees, with a massive, straight trunk, and a light and airy broad top, the best being probably *J. nigra*, one of the noblest trees of the American forest. *J. regia*, *J. Californica* and the Mexican species are tender in the North. Though many fungi and insects prey on the Walnut, none of them do very serious damage, the worst being, perhaps, the hickory-borer. The wood of the Walnut, which is easily worked and susceptible of receiving a beautiful polish, is much used for cabinet-making and the interior finish of houses, especially that of *J. nigra* and *regia*, which is heavy, strong and durable, and of dark brown color, while that of *J. cinerea* and *Sieboldiana* is light and soft. The husks of the nuts are sometimes used for dyeing yellow, and the bark for tanning leather. The husk of *J. cinerea* has some medicinal properties. The nuts of all species are edible, and are an article of commercial importance, especially those of the European Walnut, which are the best. This species is extensively grown in the warmer parts of Europe, in California and in the east from Pennsylvania to Georgia. The nuts of the native species are also sold on the market, but mostly gathered in the woods, though a number of improved varieties are in cultivation. *J. Sieboldiana* and *J. cordiformis*, with nuts superior to those of the native species, will probably become valuable nut trees where *J. regia* is too tender; the nuts of both are much valued in Japan. The Walnut grows best in moderately moist, rich soil, but *J. cinerea* is more moisture-loving and *J. regia* prefers well-drained hillsides. They are not easily transplanted when older, and therefore the nuts are often planted where the trees are to stand, but they may be safely transplanted when 2 or 3 years old, or even later when they have been transplanted in the nursery. Prop. by seeds, which should be stratified and not allowed to become dry. A light, sandy soil is to be preferred, as the young plants produce more fibrous roots, while in stiff soil they are liable to make a long taproot. The young seedlings are transplanted when about 2 years old; sometimes the taproot is cut by a long knife. Varieties are often grafted on potted stock in the greenhouse in early spring or are budded in summer, either shield- or flute-budding being employed; even top-grafting of old trees is sometimes practiced. About 10 species in N. Amer., south to Mex. and from S. E. Europe to E. Asia. Trees, rarely large shrubs: the stout branches with laminate pith: lvs. without stipules, of aromatic fragrance when bruised: staminate fls. with a 2–5-lobed perianth and 6–30 stamens, in slender catkins; pistillate fls. in few- to many-fld. racemes: ovary inferior, 1-celled, with 4 calyx lobes and included in a 3-lobed involucre: fr. a large drupe with a thick, indehiscent husk; nut 2- or 4-celled at the base, indehiscent or separating at last into 2 valves. For culture and further information, see U. S. Dept. of Agric., Nut Culture in the U. S., quoted below as U. S. N. C.; see, also, *Walnut*.



1193. Leaf of Juglans nigra (× ⅓).



1194. Pistillate flowers of Juglans cinerea. Natural size.

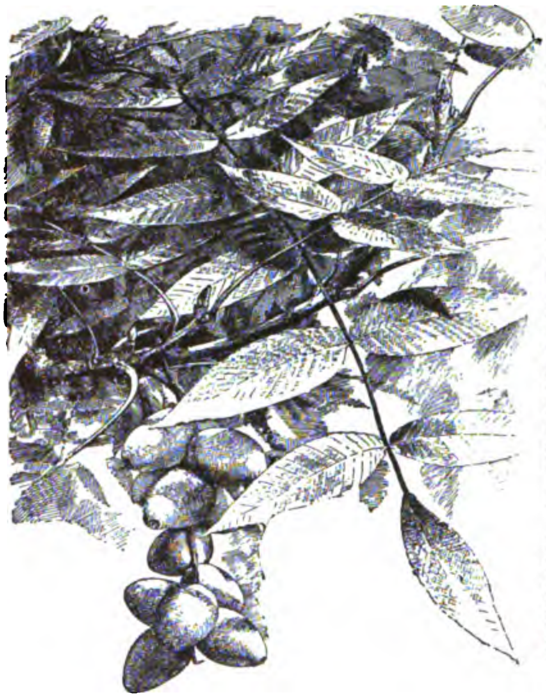


1195. Juglans Mandschurica. Natural size.

A. *Fr. glabrous or finely pubescent: nut 4-celled at the base.*

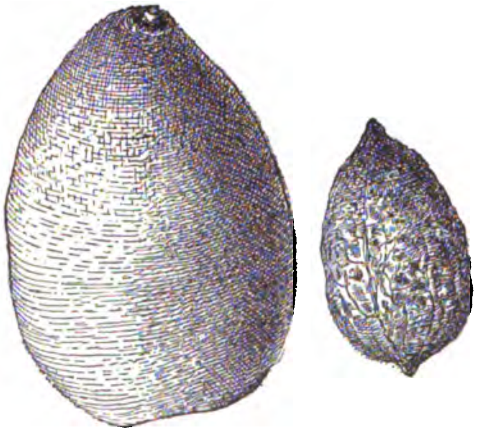
B. *Lfts. 5–13, almost entire.*

règia, Linn. Persian or English Walnut. Round-headed tree, to 70 ft.: lvs. oblong or oblong-ovate, acute



1196. Juglans Sieboldiana (×1-5).

or acuminate, almost glabrous, bright green, 2–5 in. long: fr. almost globular, green; nut usually oval, reticulate and rather smooth, rather thin-shelled. S. E. Europe, Himal., China. U. S. N. C., pl. 6. Many vars. are cultivated as fruit trees, for which see *Walnut*. Of the ornamental vars. the most distinct and decorative is var. **laciniàta**, Loud. (var. *filicifòlia*, Hort., var. *asplenifòlia*, Hort.), with narrow, pinnately cut lfts.; very effective as a single specimen on the lawn; remains usually shrubby. Var. **monophýlla**, Hort., has the lvs. simple or 3-foliolate. Var. **péndula**, Hort., has pendulous branches. Var. **præpartùriens**, Hort., is a shrubby var., producing rather small, thin-shelled nuts on very young plants. Var. **Bartheriàna**, Hort. (var. *elongàta*, Hort.). Nut elongated, narrow-oblong. R.H. 1859, p. 147; 1861, p. 427. Gn. 50:478.



1197. Juglans Sieboldiana fruits.
With and without the husk. Natural size.

BB. *Lfts. 13–25, serrate.*

Califórnica, Wats. Round-headed tree, occasionally to 60 ft., with puberulous branchlets: lfts. ovate-oblong to oblong-lanceolate, acute or acuminate, almost glabrous or puberulous when young, 2–4 in. long: stamens 30–40: ovary almost glabrous or puberulous: fr. globose, ¾–1½ in. across; nut obscurely sulcate, rather thin-shelled. Calif. S. S. 7:337. Gn. 49, p. 278.—A graceful, ornamental tree, also used as stock for grafting in Calif. The nut is of good quality but rather small.

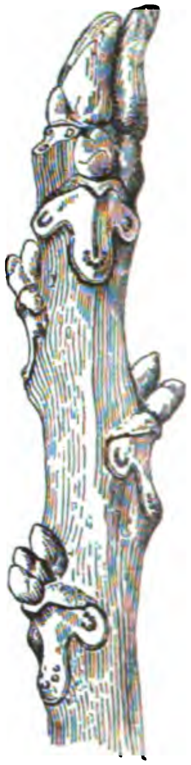
rupéstris, Engelm. Shrub or small tree, rarely to 50 ft.: branchlets pubescent when young: lfts. ovate-lanceolate to lanceolate, acuminate, puberulous or pubescent when young, 2–5 in. long: stamens about 20: ovary pubescent or tomentose: fr. globular, rarely ovoid. often pointed, usually pubescent, ½–1½ in. across; nut deeply sulcate, with longitudinal grooves, thick-shelled. with small kernel. Colo. to Tex. and northern Mex. S.S. 7:335.—The typical form has narrower, more glabrous lvs. and smaller frs., while var. **major**, Torr., the western form, is of more vigorous growth, has broader, more coarsely serrate and more pubescent lvs. and larger, less thick-walled nuts. S.S. 7:336. Probably *J. longirostris*, Carr. (R. H. 1878, p. 53), belongs here.

nigra, Linn. BLACK WALNUT. Fig. 1193. Lofty tree, to 150 ft., with rough brown bark and pubescent branchlets: lfts. oblong-lanceolate, acuminate, appressed-serrate, glabrous and somewhat shining above at length, pubescent beneath, 3–5 in. long: fr. usually 1–3 on a short stalk, 1½–3 in. across, with papillose surface; nut thick-shelled, globular or somewhat depressed, deeply furrowed. Mass. to Fla., west to Minn. and Tex. S. S. 7: 333–334. Em. 211. G.C. II. 11:373; 26:617. U.S.N.C. 7, pp. 1–3. Gn. 27, pp. 269, 270.

AA. *Fr. coated with viscid hairs: nut 2-celled at the base: lfts. with stellate and glandular pubescence beneath, serrate.*

cinèrea, Linn. BUTTERNUT. WHITE WALNUT. Fig. 1194. Large tree, occasionally to 100 ft., with gray bark: lfts. 11–19, oblong-lanceolate, acuminate, appressed-serrate, usually pubescent on both sides, more densely below, 3–5 in. long: fr. in short racemes, 2–5, oblong, pointed, 3–5 in. long; nut oblong, with 4 more and 4 less prominent irregular ribs and many broken sharp ridges between. New Brunswick to Ga., west to Dak. and Ark. S. S. 7:331–332. Em. 207. U.S.N.C. 7, p. 4.

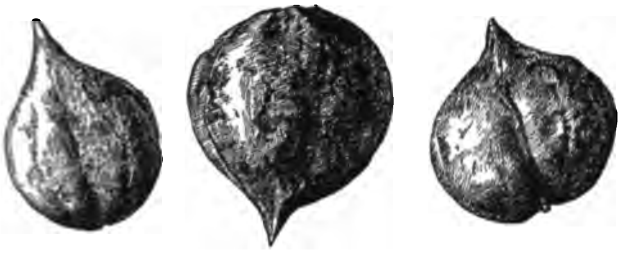
Mandshùrica, Maxim. Fig. 1195. Broad-headed tree, to 60 ft.: lfts. oblong, acute, obtusely serrate, at length almost glabrous above, pubescent beneath, rarely almost glabrous at length, 3–8 in. long: fr. in short racemes, globular ovate to oblong; nut similar to that of the former, but less sharply ridged. Mandshuria, Amurland. G.C. III 4:384. R.H. 1861, p. 429 (as *J. regia octogona*). Gn. 50. p. 478 (by error as *J. regia cordata*). U.S.N.C. 7, p. 5.



1198. Winter twig of Juglans Sieboldiana. Natural size.

Sieboldiàna, Maxim. (*J. ailantifòlia*, Carr.). Figs. 1196–8. Broad-headed tree, to 50 ft.: lfts. 11–17, oval to oval-oblong, short-acuminate, densely serrate, glabrous above, pubescent beneath, 3–6 in. long: frs. in long racemes, sometimes twenty, globose to ovate-oblong: nut more or less globose, with thick, wing-like sutures and pointed apex, the surface rather smooth, slightly rugose and pitted, 1–1½ in. long, rather thick-shelled. Japan. Gn. 47, p. 442. A.G. 11:701; 12:179. R.H. 1878, pp. 414–415. U.S.N.C. 7, p. 7.

cordifórmis, Maxim. Fig. 1199. In habit and foliage very near to the preceding, but lvs. less pubescent, and nut very different, heart-shaped, much flattened, sharply 2-edged and with a shallow longitudinal groove in the middle of the flat sides, smooth and rather thin-shelled. Japan. U.S.N.C. 7, p. 6.



1199. Juglans cordiformis. Natural size.

intermèdia, Carr. (*J. nìgra* × *règia*). Hybrid of garden origin of which two forms have been described. Var. **pyrifórmis**, Carr., with a fr. more resembling that of *J. regia*. R.H. 1863, p. 30. Var. **Vilmoriniàna**, Carr., with a fr. more like that of *J. nigra*. G.F. 4:52–53. Probably also *J. regia gibbosa*, Carr., with a large, thick-shelled, deeply rugose nut, belongs here. R.H. 1861, p. 428. Gn. 50, p. 478. Another not uncommon hybrid is J. **quadrangulàta**, Carr. (*J. cinerea* × *regia*. *J. alata*, Hort.), of which large trees are known as well in this country as in Europe. G.F. 7:435. R.H. 1870, p. 494. Hybrids between *J. Californica* and *J. regia* and between *J. Californica* and *J. nigra* have been raised by Luther Burbank, and a hybrid of *J. cinerea* and *nigra* has been reported from Germany as *J. cinerea-nigra*, Wender.

ALFRED REHDER.

JUJUBE. *Zizyphus Jujuba.*

JÚNCUS (classical name, "to join"). *Juncàceæ.* RUSHES. Grass-like plants growing in wet or rarely in dry places, and sending up from the rootstock numerous cylindrical, strict, commonly unbranched stems, which bear a terminal cyme of greenish flowers: lvs. grass-like, terete or flat: perianth of 6 rigid, chaffy parts: stamens short, either 3 or 6: capsule 3-celled or rarely 1-celled, many-seeded. Rushes differ from the true grasses and sedges in having a true perianth and a many-seeded pod. The genus includes a host of species distributed throughout the temperate regions, but only the following are in the American trade, and are used for planting in bogs and around aquatic gardens. Rushes are sold by dealers in native and aquatic plants. The kind used in making mats in Japan is procurable from dealers in Japanese plants.

effùsus, Linn. (*J. commùnis*, Hort.). COMMON RUSH. Fig. 1200. Stem soft, 1–4 ft. high, not leaf-bearing: cyme diffuse, 1–2 in. long, appearing lateral: sepals acute, equaling the short, retuse and pointless greenish brown capsule: stamens 3: seeds small, not tailed. North temperate zone. Used also for weaving into mats, etc. Var. **congéstus**. Hort. Cyme dense and capitate. Var. **vittàtus**, Buch. (*J. effùsus*, var. *aureo-striàtus*, Hort. *J. conglomeràtus variegàtus*, Hort.). Foliage striped with yellow. Var. **spiràlis**, Hort. A curious form with stems spirally twisted like a corkscrew.

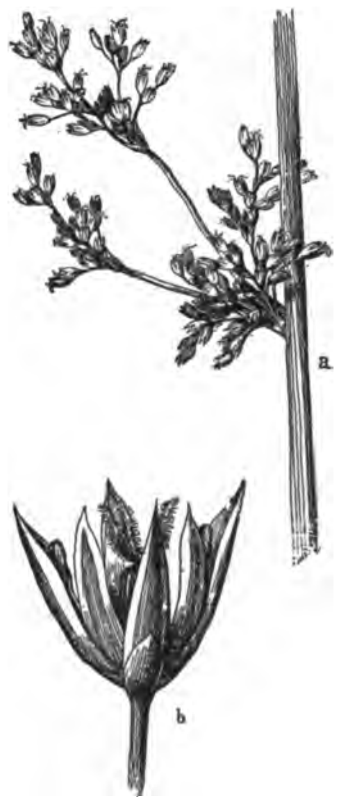
conglomeràtus, Linn. Very similar to the above: cymes congested and capitate, appearing lateral: capsule obovoid, obtuse or retuse, apiculate. North temp. regions. Differs mainly in the apiculate capsule. Probably much of the trade material named this to be referred to congested forms of *J. effusus*.

J. zebrinus, Hort. = Scirpus Tabernæmontanus, var. zebrinus.

K. M. WIEGAND.

JUNEBERRY. *Amelanchier.*

JUNÍPERUS (ancient Latin name). *Coniferæ.* JUNIPER. Ornamental evergreen trees and shrubs with opposite or whorled, needle-shaped or scale-like lvs. often on the same tree, and with inconspicuous small fls.: fr. a berry-like small cone, usually globose. Many of the species are hardy North, as *J. Virginiana*, *communis*, *rigida*, *Sabina*, *Chinensis*, *Pseudo-sabina*, *sphærica*, *Davurica*, *recurva* var. *squamata;* others are half-hardy, as *J. Oxycedrus*, *macrocarpa*, *recurva*, *excelsa*, *occidentalis*, while some, as *J. procera*, *Bermudiana*, *thurifera* and the Mexican species, can only be grown South. All are valuable ornamental plants, and the erect-growing species, mostly of pyramidal or columnar habit, are decorative as single specimens on the lawn or if planted in groups. Some varieties form a very narrow column, and are valuable for formal gardens; the columnar form of *J. Virginiana* is a good substitute in the North for the classical cypress. The low Junipers, as *J. communis* var. *nana*, *Sabina*, and *recurva* var. *squamata*, are well adapted for covering rocky slopes or sandy banks. The close-grained, fragrant wood is much used for the interior finish of houses and in the manufacture of small articles, also for posts, since it is very durable in the soil; that of *J. Virginiana* and *Bermudiana* is in great demand for pencil-making. The fruits and also the young branchlets of some species contain an aromatic oil used in medicine. The fruit of *J. drupacea* is edible. The Junipers thrive best in sandy and loamy, moderately moist soil, but grow well even in rather dry, rocky and gravelly ground. They prefer sunny, open situations. They are well adapted for hedges and for planting as shelter or wind-breaks; also for seaside planting. Prop. by seeds, which germinate usually the second and sometimes the third year, or by cuttings of nearly ripened wood in fall under glass, either outdoors or in the greenhouse. As a rule, those with needle-shaped lvs. root much easier



1200. Common Rush, Juncus effusus.
The flower-cluster, *a*, is natural size. The single flower, *b*, is enlarged.

than those with scale-like lvs., and the latter are therefore mostly increased by side-grafting during the winter in the greenhouse on young potted plants of the typical form or an allied species. The shrubby species, especially *J. Sabina*, are also prop. by layers.

About 35 species distributed throughout the extratropical regions of the northern hemisphere, in America south to Mexico and W. India. Trees or shrubs with the branchlets spreading in all directions: lvs. either all needle-shaped and in 3's, or needle-shaped and scale-like, and usually opposite, often found on the same plant, the needle shaped lvs. prevailing on younger plants and vigorous branches, the scale-like ones on older plants: fls. diœcious, rarely monœcious; staminate yellow, consisting of numerous anthers united into an ovoid or oblong catkin; pistillate greenish, minutely globular, with several bracts; each or some bearing 1 or 2 ovules; the bracts become fleshy and unite into a berry-like cone, usually wholly enclosing the 1–6, rarely 12, seeds. The fr. ripens either the first year, as in *J. Virginiana*, or the second, as in *J. Sabina* and most species, or in the third, as in *J. communis*.

Juniperus is closely allied to Cupressus, and sometimes hard to distinguish without fr.; but young plants with needle-shaped lvs. can be almost always told apart, since Juniperus has whitish lines or marks on the upper surface of the lvs., while the similar juvenile forms of allied genera have the whitish marks beneath. Most species are very variable, as well in habit as in the shape of the lvs., which renders the determination of an unknown form, at least without fr., a rather difficult task.

INDEX.

alpina, 5.
Barbadensis, 14.
Bermudiana, 14, 16.
Californica, 8.
Canadensis, 5.
Chinensis, 12.
communis, 5.
drupacea, 1.
excelsa, 10.
Fortunei, 13.
Hibernica, 5.
hemisphærica, 5.
Japonica, 12.
macrocarpa, 2.
nana, 5.
Neaboriensis, 2.
oblonga, 5.
occidentalis, 9.
Oxycedrus, 3.
phœnicea, 7.
procera, 11.
procumbens, 12, 17.
prostrata, 17.
recurva, 6.
repanda, 6.
repens, 17.
Reevesi, 12.
rigida, 4.
Sabina, 17.
sabinoides, 17 and suppl.
Schottii, 14.
Shephardi, 13.
Sinensis, 12.
sphærica, 13.
Suecica, 5.
squamata, 6.
tamariscifolia, 17.
tripartita, 14.
venusta, 10.
Virginica, 14.
Waukegan, 17.

A. *Foliage always needle-shaped and in 3's, rigid, jointed at the base: fls. axillary, diœcious: winter-buds with scale-like lvs.* (see also No. 6).

B. *Fr. large, ¾–1 in. across, with the seeds connate into a usually 3-celled bony stone.* (*Caryocedrus.*)

1. **drupàcea**, Labill. Pyramidal tree with narrow head, to 45 ft.: lvs. lanceolate, spiny-pointed, ½–¾ in. long and ⅛–⅕ in. broad (the broadest of all species), with 2 white lines above: fr. bluish black, edible. S. E. Eu., W. Asia. G.C. 1854:455; III. 19:519. R.H. 1854, p. 165.

BB. *Fr. smaller: seeds not connate, usually 3.*

C. *Lvs. with 2 white lines above.*

2. **macrocárpa**, Sibth. (*J. Neaboriénsis*, Gord.). Shrub or small tree, to 12 ft., of dense pyramidal habit: lvs. crowded, linear-lanceolate, spiny-pointed, spreading, ½–¾ in. long: fr. to ½ in. across, dark brown, glaucous. Mediterranean region.

3. **Oxycèdrus**, Linn. Bushy shrub or small tree, to 12 ft., with rather slender branches: lvs. linear, spiny-pointed, spreading, ½–¾ in.: fr. globose, ¼–⅓ in. across, brown, shining, not or slightly glaucous. Mediterranean region.

CC. *Lvs. with one white line above.*

4. **rigida**, Sieb. & Zucc. Small, pyramidal tree, to 30 ft., or spreading shrub with the slender branches pendulous at the extremities: lvs. in closely set whorls, narrow-linear, stiff, yellowish green, ½–1 in. long: fr. about ¼ in. across, dark violet. Japan. S.Z. 125.—Graceful, hardy shrub, somewhat similar to *J. communis*, var. *oblonga*, but the lvs. more crowded and stiffer.

5. **commùnis**, Linn. COMMON JUNIPER. Shrub, with procumbent, spreading or erect branches, sometimes tree becoming 40 ft.: lvs. linear or linear-lanceolate, concave and with a broad white band above, spiny-pointed, ⅓–¾ in. long: fr. almost sessile, dark blue, glaucous, ¼–⅓ in. across. Widely distributed through the colder regions and mountains of the northern hemisphere in many different forms. Some of the most important varieties are the following: Var. **àureo-variegàta**, Hort. Upright form, with the tips of the branchlets golden yellow. Var. **Canadénsis**, Loud. (*J. Canadensis*, Loud. *J. nana Canadensis*, Carr.). Similar to var. *nana*, but higher and more erect and the lvs. somewhat longer and narrower. Var. **Canadénsis àurea**, Hort. Like the former, but tips of branchlets golden yellow. Var. **hemisphǽrica**, Parl. (*J. hemisphærica*, Presl). A low, dense, rounded bush, rarely more than 3 ft. high: lvs. straight and stiff, short. Mountains of southern Eu. and N. Afr. Var. **Hibérnica**, Gord. (var. *stricta*, Carr.). Fig. 535, Vol. I. Narrow, columnar form, with upright branches, deep green, tips of branchlets erect. Var. **nàna**, Loud. (*J. nàna*, Willd. *J. alpina*, S. F. Gray. *J. Sibírica*, Burgsd.). Fig. 1201. Low-spreading or procumbent shrub, seldom over 2 ft. high: lvs. oblong-linear, abruptly pointed, usually incurved, densely clothing the branches, with a broad silvery white line above, ¼–½ in. long. Arctic and mountainous regions. Var. **oblónga**, Loud. (*J. oblónga*, Bieb.). Upright shrub, with slender, diverging and recurving branches: lvs. thin, long-attenuate, horizontally spreading, bright green. Transcaucasia. Var. **oblóngo-péndula**, Carr. (var. *refléxa*, Parl.). Similar to the preceding, but more decidedly pendulous. A very graceful form. Var. **pendula**, Carr. Shrub, with spreading, recurving branches and pendulous branchlets. Var. **Suècica**, Loud. (var. *fastigiàta*, Hort.). Narrow, columnar form, growing sometimes into a tree to 40 ft. high, with rather long, spreading lvs., the branchlets with drooping tips: of lighter and more bluish color than the similar var. *Hibernica*. Var. **vulgàris**, Loud. Bushy shrub or small tree, with usually upright or sometimes spreading branches: lvs. linear, straight and spreading. This is the common European form, sometimes hard to distinguish from the American upright form, var. **erécta**, Pursh, which, however, has not the columnar habit so common with the European variety, and has the lvs. more silvery white above, of lighter green and mostly slightly curved.

1201. Juniperus communis, var. nana.

AA. *Foliage usually of two kinds of lvs.* (Fig. 1203) *and opposite, decurrent: fls. terminal: no distinct winter-buds.*

B. *Lvs. in 3's, lanceolate, short, loosely appressed: fr. oblong.*

6. **recúrva**, Hamilt. (*J. repánda*, Hort.). Shrub or small tree, to 30 ft., with spreading and usually recurving branches: branchlets rather thick: lvs. linear-lanceolate, pointed, grayish or glaucous green with a whitish band above: fr. about ⅓ in. long, 1-seeded. Himalayas. G.C. II. 19:468. Gn. 36, p. 215. Var. **dénsa**, Carr. Dwarf, with short, crowded branchlets: lvs. curved, grayish green. Var. **squamàta**, Parl. (*J. squamàta*, Hamilt.). Prostrate, with long, trailing branches and numerous short branchlets: lvs. straight, slightly spreading, glaucous or bluish green. Much hardier than the type.

BB. *Lvs. mostly opposite, scale-like or of two kinds, usually with a gland on the back: fr. mostly globular.*

C. *Fr. erect or nodding: mostly trees.*

D. *Color of fr. reddish brown, with rather dry, fibrous flesh: lvs. minutely denticulate.*

7. **phœnícea**, Linn. Shrub or small tree, to 20 ft., with ovate-pyramidal head and upright branches:

branchlets slender: lvs. acicular and spreading or scale-like, imbricate, rhombic, obtuse, opposite, often bluish green: fr. ⅙-⅓ in. across, shining, with 3–6 seeds. S. Eu., N. Afr.

8. **Califórnica,** Carr. Fig. 1202. Pyramidal tree, to 40 ft., or shrub with many erect branches: branchlets rather stout: lvs. usually in 3's, imbricate, rhombic, obtuse, thick, yellowish green, with conspicuous gland, only on vigorous branches acicular: fr. ¼-⅓ in. long, with bluish bloom and with 1–2 large seeds. Calif. S.S. 10:517. R.H. 1854, p. 353.

DD. *Color of fr. bluish black or blue, with juicy, resinous flesh.*

E. *Imbricate lvs. usually in 3's, minutely denticulate.*

9. **occidentàlis,** Hook. Tree, to 40 feet, rarely to 60 ft., with spreading branches forming a broad, low head, or shrub with several upright stems: branchlets stout and thick, imbricate, ovate, acute, grayish green, rarely acicular: fr. subglobose or ovoid, ¼-⅓ in. long, with 2–3 seeds. Washington to Calif. S.S. 10:521.

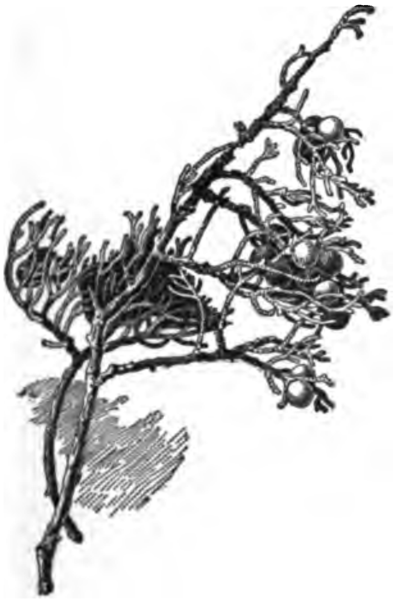
EE. *Imbricate lvs. opposite, entire or nearly so.*

F. *Seeds of fr. 2–6.*

G. *Shape of imbricate lvs. acute: branchlets slender.*

10. **excélsa,** Bieb. Tree, to 60 feet, with pyramidal head and upright or spreading branches: lvs. ovate, spreading, in 3's, on the lower branches, but mostly opposite, rhombic, bluish green: fr. bluish black, bloomy, globular, about ⅓ in. across, with 3–6 seeds. Greece, W. Asia to Himal. Gt. 46, p. 209. Var. **stricta,** Hort. Of upright, columnar habit, with very glaucous foliage. Var. **venústa,** Hort., seems hardly different from the former.

11. **pròcera,** Hochst. Tree, to 100 or 150 ft., similar to the preceding: lvs. in 3's, or opposite, lanceolate and spreading or loosely appressed and ovate-lanceolate: fr. globose, small, about ⅙ in. across, 2–3-seeded. Mts. of E. Afr.—Probably the tallest species of the genus.



1202. Juniperus Californica (× ⅓).

GG. *Shape of imbricate lvs. obtuse.*

12. **Chinénsis,** Linn. Tree, to 60 ft., or shrub, sometimes procumbent: branches rather slender: lvs. opposite or whorled, linear, pointed and spreading, with a white band above or scale-like, appressed, rhombic, obtuse: fr. globular, brownish violet, bloomy, one-fifth to ⅓ in. across, with 2 or 3 seeds. Himal., China, Japan. S.Z. 126, 127.—Very variable in habit: the staminate plant usually forms a much-branched, upright, pyramidal bush, often almost columnar, while the pistillate has slender, spreading branches. They are therefore often distinguished as var. **máscula** and var **fémina** (var. *Reèvesi,* Hort.). The first one is the most desirable as an ornamental plant. Var. **argénteo-variegàta,** Hort. Dwarf, dense form, with dimorph lvs.: tips of branchlets mostly white. Var. **aùrea,** Hort. (var. *máscula aùrea,* Hort.). Upright form, with the young branchlets golden yellow, the color becoming more brilliant in the full sun. Var. **péndula,** Hort. With spreading branches, pendulous at the extremities. Var. **pyramidàlis,** Carr. Narrow, pyramidal form, with bluish green, mostly needle-shaped foliage. Var. **procúmbens,** Endl. (*J. procúmbens,* Sieb. *J. Japónica,* Carr.). Dense, low shrub with spreading, sometimes procumbent branches and mostly acicular lvs. in whorls, with two white lines above, longer and stouter than in the type. S.Z. 127, fig. 3. Var. **procúmbens aùrea,** Hort. Branches robust and long, decumbent, with rather few branchlets, young growth golden yellow at first, changing to light green. Var. **procúmbens álbo-variegàta,** Hort. Rather dense, bluish green form, variegated with white. Var. **procúmbens aùreo-variegàta,** Hort. Dwarf, dense form, variegated with golden yellow.

13. **sphǽrica,** Lindl. (*J. Fórtunei,* Van Houtte). Similar to the former. Densely branched shrub or tree, to 30 ft., with upright branches: branchlets short, rather thick, quadrangular: lvs. acicular and whorled, but less rigid than those of the former, or scale-like, rhombic-oblong, somewhat spreading: fr. globular, about ⅓ in. across, not bloomy, 3-seeded. N. China. P.F.G. 1, p. 59. Var. **glaùca,** Gord. (*J. Shéphardi,* Hort.). Dense form, with usually needle-shaped glaucous foliage.

FF. *Seeds of fr. 1–2, small, ⅙–⅓ in. across.*

14. **Virginiàna,** Linn. RED CEDAR. SAVIN. Fig. 1203. Tree, to 100 ft., with conical head and spreading or upright branches: lvs. acicular, spiny-pointed, spreading or scale-like, rhombic, acute or subacute, imbricate, very small: fr. brownish violet, bloomy, globular or ovoid. Canada to Fla., east of the Rocky Mts. S.S. 10:524. G.F. 8:65; 10:145.—A very variable species. Some of the most important varieties are the following: Var. **álbo-variegàta,** Hort. Branchlets variegated with white. Var. **aùreo-variegàta,** Hort. With golden yellow variegation. Var. **Barbadénsis,** Gord. (var. *grácilis,* Sarg. Var. *Bedfordiàna,* Veitch. *J. Bermudiàna,* Hort., not Linn.). Tree, with slender, spreading branches, pendulous at the extremities: lvs. bright green, spiny-pointed, mostly needle-shaped on the cult. plants. Gulf states, Jamaica, Barbadoes. Tender. Var. **dumòsa,** Carr. Dense shrub, forming a rounded pyramid, with mostly needle-shaped, bright green lvs. Var. **elegantissima,** Hort. Tips of young branchlets golden yellow. Var. **glaùca,** Carr. Vigorous-growing form, with glaucous foliage. Var. **péndula,** Carr. With spreading limbs and slender, pendulous branches: lvs. usually scale-like. Var. **pyramidàlis,** Carr. Dense, columnar form, with the foliage glaucous (var. *pyramidàlis glaùca*) or bright green (var. *pyramidàlis viridis*). Var. **réptans,** Beissn. Low shrub, with horizontally spreading, procumbent branches and slender, curving branchlets: bright green. M.D.G. 1896:296. Probably the same as var. *horizontalis,* Arb. Kew. Var. **Schótti,** Hort. A dwarfish, dense, pyramidal form, with bright green and rather light foliage. Var. **tripartita,** Hort. A dwarf, spreading form, densely branched, with acicular, glaucous lvs.—The dwarf forms are often very similar to *J. Sabina* and hard to distinguish without frs. except by the strong, disagreeable odor of the bruised branchlets of the latter.

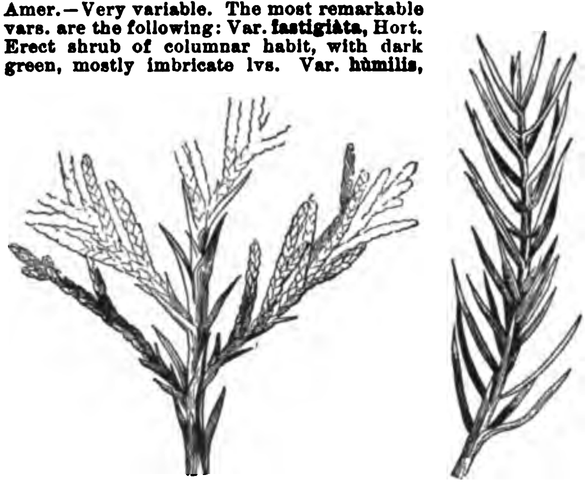
15. **scopulòrum,** Sarg. Closely allied to the preceding, but considered by the author as a distinct species, chiefly distinguished by the somewhat larger fr., ripening not until the second year; by its habit, forming a broad head with stout, spreading branches and often dividing into several stems near the base, and by its shredding bark. The branchlets are somewhat shorter and stouter, and the foliage usually glaucous or yellow-

ish green. Brit. Columb. to Calif. in the Rocky Mts. G.F. 10:423.

16. **Bermudiàna,** Linn. Tree, to 40 ft., in habit much like *J. Virginiana*, but branches much stouter and foliage pale bluish green: branchlets thickly set, quadrangular, stout and short: lvs. mostly imbricate, thick or acicular, spiny-pointed, rigid, erect-spreading: staminate catkins larger: fr. usually 2-seeded and depressed-globular. Bermuda and cult. in other W. Indian Islands. G.C. II. 19:657. G.F. 4:295.

cc. *Fr. pendulous, on curved peduncles, small: shrubs, usually spreading or procumbent.*

17. **Sabina,** Linn. Spreading or procumbent shrub, rarely with erect stem, to 10 ft.: branchlets rather slender, of a very strong, disagreeable odor when bruised: lvs. needle-shaped, acute and slightly spreading or imbricate, oblong-rhombic, acute or subacute, usually dark green: fr. one-fifth to ¼ in. thick, globular, 1–3-seeded. Mts. of middle and southern Eu., W. Asia, Siber., N. Amer.—Very variable. The most remarkable vars. are the following: Var. **fastigiàta,** Hort. Erect shrub of columnar habit, with dark green, mostly imbricate lvs. Var. **hùmilis,** Endl. Procumbent, with ascending thickish branchlets: lvs. usually imbricate, scale-like, often bluish green. Var. **prostràta,** Loud. (var. *procùmbens*, Pursh. *J. prostràta*, Pers. *J. rèpens*, Nutt. *J. procùmbens*, Nichols.). Procumbent, rarely ascending, with usually trailing, long branches, furnished with numerous short branchlets: lvs acicular, spiny-pointed or imbricate, acute, bluish or glaucous green: fr. globular, blue and bloomy. Nova Scotia to Brit. Columb., south to N. Y. and Wyo. Sometimes called Waukegan Juniper. Var. **tamariscifòlia,** Ait. (*J. sabinoides*, Griseb.). Procumbent or ascending, rarely erect: lvs. usually all needle-shaped and often in 3's, slightly incurved, dark and bright green, with a white line above. Mountains of S. Eu. Var. **variegàta,** Hort. Branchlets variegated with creamy white: lvs. mostly imbricate.



1203. The two kinds of red cedar leaves. Natural size.

The right hand specimen shows the foliage of red cedar on young shoots; the other shows the two kinds.

J. Davùrica, Pall. Allied to J. Sabina. Procumbent, with slender, spreading or drooping branchlets: fr. 1–4-seeded, small. Siberia.—*J. fœtidissima*, Willd. Allied to J. excelsa. To 12 ft. high: branchlets thicker: lvs. with spreading apex, mucronate, usually eglandular: fr. larger, 1–2-seeded. Greece, W. Asia.—*J. flàccida*, Schlecht. Graceful tree, to 30 ft., with spreading branches and slender, remote, pendulous branchlets: lvs. acute, with spreading tips: fr. globular, 5–10-seeded. Tex., Mex. S.S. 10:519.—*J. litoràlis*, Max. (J. conferta, Parl.). Allied to J. rigida, but prostrate, with long, trailing branches: fr. larger. Japan.—*J. macrópoda*, Boiss. Allied to J. excelsa. Shrub or small tree, to 30 ft., sometimes procumbent: lvs. closely appressed: fr. nodding, globular, 4-seeded. Persia to Himal.—*J. Mexicàna*, Schiede. Pyramidal tree: branchlets numerous, short and rather stout: lvs, acute, loosely appressed: fr. 2–4-seeded. Mex.—*J. monospérma*, Sarg. (J. occidentalis, var. monosperma, Engelm.). Closely allied to J. occidentalis. Branchlets more slender: lvs. usually opposite and eglandular: fr. smaller and usually 1-seeded. Rocky Mts., from Col. to New Mex. S.S. 10:522.—*J. pàchyphlœa*, Torr. Tree, to 60 ft., allied to J. occidentalis, with broad, pyramidal or round-topped head: lvs. usually opposite, glandular, bluish green: fr. dark reddish brown, bloomy, with usually 4 seeds. Has a checkered bark like a black-jack oak. Col. to Tex. and New Mex. S.S. 10:520.—*J. Pseùdo-sabìna*, Fisch. & Mey. Allied to J. Sabina. Erect shrub, with thick, dense and short branchlets: lvs. usually dimorph; fr. ovate, blackish, glossy, 1-seeded. Siber.—*J. sabinoides*, Endl.=J. thurifera.—*J. sabinoides*, Nees=J. tetragona.—*J. Sánderi*, Hort., recently introduced from Japan, is a juvenile form of a Chamæcyparis, probably C. obtusa. It is a dense shrub with needle-shaped bluish green lvs.—*J. tetrágona*, Schlecht. Allied to J. occidentalis. Small tree, to 20 ft., rarely to 40 ft., with round-topped or pyramidal head and slender, quadrangular branchlets: lvs. obtuse, usually eglandular: fr. subglobose, mostly 1-seeded. Tex. to Mex. S.S. 10:523.—*J. thurífera*, Linn. Shrub or tree, to 40 ft., with round-topped head and spreading branches: branchlets slender: fr. globular, 2–3-seeded. Spain, Algeria.—*J. Utahénsis*, Lemm. (J. Californica, var. Utahensis, Engelm.). Bushy tree, rarely more than 20 ft., with broad, open head: branchlets slender: lvs. obtuse, light yellowish green: fr. usually 1-seeded. Col. to Calif., west to Utah. S.S. 10:518.

Alfred Rehder.

JUPITER'S BEARD. *Centranthus ruber* and *Anthyllis Barba-Jovis.*

JUSSIÆA. See *Jussieua.*

JUSSIEÙA (the Jussieu family contained five botanists, of whom the most distinguished was Antoine Laurent de Jussieu, 1748–1836, who laid the foundations of a modern natural system of the vegetable kingdom). Also written *Jussiæa*. *Onagràceæ*. About 30 species of tropical plants, largely bog and aquatic herbs and shrubs, one of which is cult. in America. It grows 2–3 ft. high, and produces numerous axillary fls. of a bright yellow, somewhat like an evening primrose. It is little cult., but desirable for planting at the edge of a pond of tender aquatics or for tub culture. Jussieua is allied to Ludwigia, and distinguished by the following characters: petals 4–6, not clawed, entire or 2-lobed: stamens 8–12: ovary 4-celled. Jussieuas have alternate lvs., which are mostly membranous and entire, rarely leathery and serrate: fls. yellow or white, solitary, short or long-pedicelled.

longifòlia, DC. Erect, glabrous: stem 3-angled: lvs. sessile, lanceolate-linear, acuminate at both ends, glandular beneath at the margins: pedicels 1-fld., longer than the ovary, and bearing 2 bractlets at the apex: petals 4, obovate, scarcely notched at the apex: stamens 8. Brazil. W. M.

The plant in the trade as *J. longifolia* is a summer-flowering aquatic herb, and differs somewhat from the description given above. The stems of young seedlings are 4-winged, and a specimen before the writer of a plant of the previous season is 5-winged. The main root of these old plants may be tuber-like, 3 in. long, ½ in. thick, or 8–10 in. long and more slender. Also the lower lvs., at least, are opposite. *J. longifolia* is best treated as a tender annual.

The seed may be sown in fall or spring in shallow water, using seed-pans or pots, as with other flower seeds. Cover the seed, which is very fine, with finely sifted soil, place the pot or seed-pan in water, but do not submerge until the second day, when the seed will be thoroughly soaked and will not float on the surface of the water. When the plants attain a few leaves they should be potted, singly, into thumb-pots, and later into 3-in. pots, and from these planted into their summer quarters. It is not absolutely necessary to keep these plants always submerged in water after potting. The plants will do well on a bench, which should be covered with sand or ashes and the plants kept well watered.

Wm. Tricker.

JUSTÍCIA (James Justice, a Scotch gardener and author of 18th century). *Acanthàceæ*. A large and polymorphous genus (perhaps 100 species) in the warm parts of the Old and New World. They are mostly herbs of various habits, with opposite entire lvs., and are cult. under glass for the showy fascicles or heads of fls. Most of the garden plants which are known as Justicias are Jacobinias. Consult Jacobinia, for example, for *Justicia magnifica*, *J. carnea*, *J. Pohliana*, *J. velutina*, *J. coccinea*, *J. Ghiesbreghtiana* and *J. Lindeni*. *Justicia Adhatoda* is *Adhatoda Vasica*. Others may belong to Thyrsacanthus and Dædalacanthus. The *Justicia variegata* of catalogues is probably not the *J. variegata* of Aublet and the botanists, but is very likely a variegated-leaved form of some Jacobinia. From Jacobinia the species are distinguished by the spurred or appendaged anthers. The corolla is red, purple or white, tubular, deeply 2-parted or lipped: stamens 2: seeds normally 4, in an ovate or oblong capsule: fls. in bracted heads or fascicles.

The remarks on the culture of Jacobinias will apply here. Plants are secured readily from cuttings made in late winter or spring, and these should bloom the coming fall or winter. After blooming, discard the plants, except such as are to be kept for furnishing cuttings. Unless well headed back, old plants become loose and weedy, and they take up too much room.

It is not known that any true Justicias are in the Amer. trade. *J. flava* is probably not the *J. flava* of the botanists, but perhaps a Jacobinia or some other acanthad. "It is covered for months with large, feather-like clusters of pure yellow flowers, remaining perfect for a very long time, and enhanced by dark green, shiny foliage."

L. H. B.

JUTE is a fiber plant, of easy culture in warm climates. It has been successfully grown in the Gulf states, but, according to the Department of Agriculture, the want of a suitable machine for separating the fiber is the great obstacle which prevents the growth of the Jute-fiber industrv in America. See *Corchorus*.

K

KADSÙRA (Japanese name). *Magnoliàceæ.* About 7 species, tropical Asian woody climbers, of one of which Charles S. Sargent writes (G.F. 6:75): "The flowers are not at all showy, but it is a plant of extraordinary beauty in the autumn when the clusters of scarlet fruit are ripe, their brilliancy being heightened by contrast with the dark green, lustrous, persistent leaves. * * * It might well be grown wherever the climate is sufficiently mild, as in the autumn no plant is more beautiful." Kadsuras have leathery or rarely membranous foliage: fls. axillary, solitary, whitish or rosy, unisexual; sepals and petals 9–15, gradually changing from the outermost and smallest to the innermost and petaloid: staminate fls. with an indefinite number of stamens, which are separate or coalesced into a globe: carpels indefinite in number, 2–3-ovuled: mature berries in globular heads.

Japónica, Linn. Small, procumbent, warty shrub: lvs. oval or oblong-oval, thick, serrate: peduncles 1-fld., solitary. Japan, as far as 35° north latitude.—The type is advertised by Japanese dealers; also a variety with foliage blotched with white, and another var. with foliage margined white.

KÆMPFÈRIA (Engelbert Kæmpfer, 1631–1716, traveled in the Orient, and wrote on Japan. He is also commemorated by *Iris Kæmpferi*). *Scitaminàceæ.* About 18 species of tropical African and Asian plants with tuberous or fleshy roots, often stemless, and bearing the peculiar fls. of this order in which the showy parts, as in the Canna, are the staminodes. For culture, see *Hedychium* and *Zingiber.*

A. *Foliage margined with white.*

Gilberti, Hort. Fleshy-rooted: lvs. oblong-lanceolate, deep green, bordered white, wavy at the margin: fls. purple and white. East Indies. G.C. II. 17:713. R.B. 21:169. S.H. 2:131.—Int. by W. Bull, 1882. Reasoner Bros. cultivate this outdoors in S. Fla., and say, "The fls. are borne on ornamental crimson heads rising from the ground on separate stalks, and resembling in outline small pineapple fruits. These heads retain their beauty all summer."

AA. *Foliage not margined with white.*

B. *Lvs. tinged purple beneath.*

rotúnda, Linn. Stemless, tuberous: lvs. not produced until after the fls., oblong, erect, petioled: corolla segments long-linear: staminodes oblong, acute, white, 1½–2 in. long: lip lilac or reddish, deeply cut into 2 suborbicular lobes: anther-crest deeply 2-fid: petiole short, channelled: blade 12 in. long, 3–4 in. wide, usually variegated with darker and lighter green above and tinged purple beneath: spikes 4–6-fld., produced in Mar. and Apr. India. B.M. 920 and 6054.—Adv. 1895 by Pitcher & Manda, who said the fls. were fragrant.

BB. *Lvs. not tinged purple beneath.*

Kirkii, Schumann (*Cienkówskya Kirkii*, Hook.). Leaf-stem 3–4 in. long: lvs. about 4, crowded at the apex of the stem, oblong, acute, 8–9 in. long, 2½–3 in. wide at the middle: flowering stems short, slender, 1-fld.: corolla lobes oblong-lanceolate, 1 in. long: staminodes more than twice as long as the corolla lobes, pale rose-purple: lip rounded at the apex, slightly notched, 2 in. broad, with a yellow mark at the throat. Trop. Afr. B.M. 5994. I.H. 30:495.—Once adv. by John Saul.

W. M.

KAFFIR CORN. See *Sorghum.*

KAGENÉCKIA (after an Austrian minister to Spain). *Rosàceæ.* Six species of tender evergreen trees from Chile and Peru, one of which is cult. at Santa Barbara. The fls. are white, 5-petaled, about ¾ in. across, and unisexual. The male fls. are borne in racemes or corymbs; the females are solitary; all are terminal: lvs. leathery, serrate, short-stalked: stamens 16–20, inserted on the mouth of the calyx, in 1 series: carpels 5, free: ovules numerous, in 2 series.

oblónga, Ruiz & Pav. Lvs. oblong, acuminate at both ends, the serrations obtuse and rather callous. Chile.—Int. 1900 by Franceschi.

KAKI. See *Persimmon* and *Diospyros.*

KALÁNCHOË (Chinese name). *Crassulàceæ.* Sometimes spelled *Calanchoë.* About 50 species of succulent erect shrubs, chiefly of tropical Africa, but also inhabiting tropical Asia, S. Africa and Brazil. Lvs. opposite, sessile or stalked, varying from entire to crenate and pinnatifid: fls. yellow, purple or scarlet, in many-fld. terminal cymes, rather large and often showy; calyx 4-parted, the narrow lobes shorter than the corolla tube, usually falling early; corolla 4-parted and usually spreading; stamens 8: carpels 4. A few species are prized by amateurs. The fls. are lasting in bouquets. The foliage is ornamental and interesting. Culture of *Crassula*, which see also for a conspectus of the garden crassulaceous genera. The four following species are novelties. *K. pinnàta*, Pers. (Mn. 2:56), is *Bryophyllum calycinum* (which see).

A. *Flowers scarlet or orange.*

coccínea, Welw. Somewhat hairy above, 2–4 ft. tall: lower lvs. ovate-obtuse, coarsely crenate-dentate, stalked; upper lvs. linear-lanceolate-obtuse, sessile: fls. scarlet or orange, on short pedicels, in broad, forking panicles which have stalks about 1 ft. long; calyx pubescent, the segments lanceolate-acute; corolla tube ½ in. long, the limb ⅓ in. across, and the segments deltoid-ovate. Trop. Africa.

flámmea, Stapf. A foot to 18 in. high, glabrous, little branching: lvs. ovate-oblong, obtuse, narrowed into a short petiole (blade about 2 in. long and 1¼–1½ in. wide), fleshy, obscurely crenate-dentate or almost entire: fls. yellow and orange-scarlet, ½ in. across; calyx parted to the base, the segments linear-lanceolate and somewhat acute; corolla tube 4-angled, less than ½ in. long, yellowish; lobes ovate-acute, orange-red. Trop. Afr. B.M. 7595. G.C. III. 26:47.—First fully described in Kew Bulletin, Aug.–Sept., 1897, p. 266, but it was named and partially described in G.C. July 10, 1897, as *K. flamea*, which is evidently an orthographical error. The plant is one of the leading novelties of 1900. Thrives in a comparatively cool greenhouse.

AA. *Flowers pink.*

cárnea, Mast. Stems simple, 2 ft. or less, glabrous: lvs. oval or obovate, obtuse, crenate-dentate, narrowed into a short petiole, the upper ones nearly linear and sessile: fls. light rose or pink, very fragrant, nearly ½ in. across; calyx parted to the base, the segments linear-pointed; corolla tube swollen at base, and 2–3 times longer than calyx; corolla lobes broad-oval, acute. S. Afr. G.C. III. 1:211. G.F. 3:53.—Good winter bloomer. prop. by seeds or cuttings. Seeds sown in spring give blooming plants for the following Christmas.

AAA. *Fls. white or white-yellow, very long.*

marmoràta, Baker (*K. grandiflòra*, Rich., not Wight). Stem stout and branching: lvs. large (6–8 in. long), obovate, narrowed to a short broad petiole, crenate, blotched with purple: fls. long and tubular (3 in. or more long), creamy white or yellowish, the lobes ovate-acuminate. Abyssinia. B.M. 7333. I.H. 43, p. 45.—Interesting pot-plant, with large trusses of erect fls.

L. H. B.

KALE or **BORECOLE** (*Brassica oleracea*, var. *acephàla*, Figs. 295, 296) is thought by some to be the original type of the cabbage. Members of this section of the cabbage tribe do not form heads, but have variously colored, often finely cut, leaves with fleshy leaf-stems, which form part of the edible portion. These leaf-stems are tough in the early autumn, but become crisp and palatable with the accession of autumn frosts. The plant is exceedingly hardy; in the southern states it winters without injury and in the Atlantic states may be carried through with slight winter protection. For autumn use the seeds are sown in early spring under glass or in coldframes and treated exactly as cabbage. In the South the seed may be sown in August or September, and the plants are ready for use the following spring. In the colder regions they may be carried through the winter in coldframes. Leading types: (1) Dwarf Scotch Curled; (2) Tall Green Curled; (3) Variegated; (4) Purple. There are many intermediate forms. The finely cut varieties of Scotch Kale are now frequently used for bedding purposes. Their hardiness gives them special features of usefulness in the autumn. Kale is adapted to a wide range of country. One of the leading Kale centers is Norfolk, Va., where it is grown during fall and winter for the early northern market. See also *Brassica* and *Cabbage*. John Craig.

The Dwarf Scotch Kale makes a most excellent plant for spring greens. It is hardy enough to stand the winters of western New York without protection uninjured, and to make a new growth of tender sprouts very early in spring. These sprouts are serviceable for greens, salads, etc. For this purpose we sow seed early in June, either in a seed-bed and transplant the seedlings, just as we do cabbages, or directly in the hill, thinning to one plant in a hill. In a general way, the plant is handled like late cabbage. T. Greiner.

Kale at Norfolk (Fig. 1204).—Truckers about Norfolk, Va., grow both the Scotch and the Blue Kale, more of the former than of the latter. The amount of Kale shipped from Norfolk one year with another will average somewhere between 175,000 and 200,000 barrels. The number of barrels shipped in a single season has reached as high as a quarter-million.

The soil most desirable is a clay loam,—just such land as is best adapted to the growth of cabbages. The seed is sown with a hand drill in August, and shipments therefrom begin in October following, and continue off and on throughout the winter, until the crop is entirely shipped,—say until April 1 to 15 following. As soon as the frosts in the vicinity of New York and Philadelphia have been sufficiently heavy in the fall to kill all outdoor vegetables, Norfolk Kale is in fairly good demand and brings from 75 cts. to $2 per barrel in northern markets. The yield per acre ranges from 200 barrels up to 400. Instances have been known in which more than 600 barrels of the Mammoth Kale have been raised from an acre of ground. It is a cheap crop to raise, requiring not more than half as much fertilizer as the spinach crop.

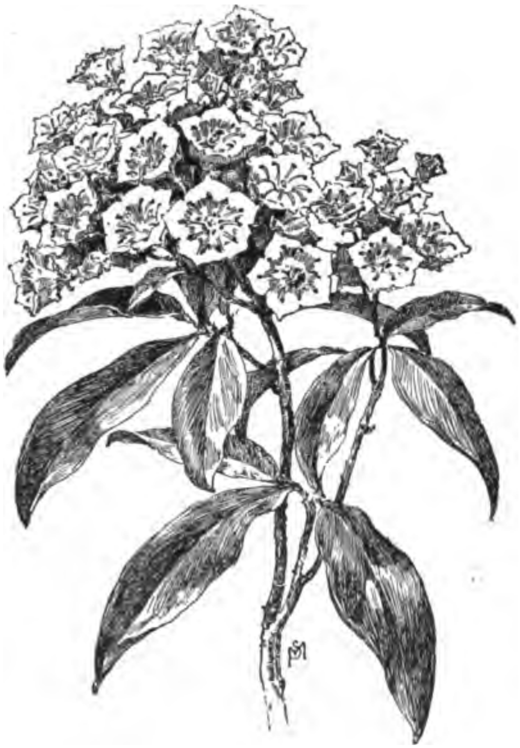
The soil is prepared, generally, in the following manner: It is thoroughly plowed, say about August 1, and harrowed level and smooth, and as the lands are very loose the Kale bed, although it may comprise 100 acres, is as mellow and as friable as the best of garden lands anywhere. A little later in the month the soil is thrown up with a single plow into small beds or ridges. Sometimes a single row will be sown by itself on a little ridge. Sometimes a ridge will be wider, and two rows will be grown thereon. Sometimes four or five rows are thus sown; but as the soil must be relieved of the winter's rains, the beds are generally narrow, with little furrows between them to draw off any surplus water which may fall during the winter months, as we have from 2 to 6 inches of rain per month throughout the year. After the plants are well up they are tilled between the rows with cultivator or small plow, and hands are sent through the field with small hand hoes to thin out the crop, leaving healthy plants at about 6 inches apart. In the warm and sunny days of September, October and November the plant makes a heavy growth, covering the earth entirely in many instances. Then the trucker, if the demand for Kale be good, can thin out and sell the surplus plants, leaving the remainder to reach a greater degree of development; or he can cut clean as he goes, and put the same land into radish or winter peas later in the winter.

1204. A Norfolk Kale field at the Christmas harvest time.

There is money in the Kale crop at 75 cts. per barrel. During the past season the price has ranged from 50 cts. to $2 per barrel, and has paid very well indeed. Within 15 miles of Norfolk, something over 1,000 acres is devoted to Kale each year. It is considered one of the cheapest crops to grow, yielding a moderate percentage of profit. If the soil is in good or fair condition, very little fertilizer or manure is required for the Kale crop. Its cultivation is simple and inexpensive. It is cut when ready for market and packed in barrels, using canvas for one of the barrel heads, at a cost of 5 cts. per barrel for cutting. A. Jeffers.

KALE, SEA. *Crambe maritima;* but treated under *Sea-Kale*.

KÁLMIA (after Peter Kalm, Swedish botanist, traveled 1748–51 in N. America). *Ericàceæ.* American Laurel. Beautiful ornamental evergreen shrubs, rarely deciduous, with entire opposite or alternate lvs. and purple, pink or almost white showy fls. in terminal corymbs or in axillary umbels, rarely solitary: fr. capsular. Most of the species are hardy North, particularly the most ornamental member of the genus, *K. latifolia*, which next to Rhododendron is the most beautiful flowering hardy evergreen. Massed in groups or as single specimen on the lawn, it is one of the most decorative plants when covered with its abundant pink flowers. Even small plants produce flowers. The foliage is very decorative, contrasting well with the red and yellowish branches. The species is also easily forced and makes a very handsome pot-plant. The other species are pretty border plants for evergreen shrubberies. The Kalmias thrive well in a sandy, peaty or loamy soil, but dislike clay and limestone. They grow almost as well in swamps as in drier locations and prefer partly shaded situations, but thrive also well in sunny places, provided there be sufficient moisture. They require generally almost the same treatment as the hardy Rhododendron, but are less particular about soil and position. Transplanting, if carefully done either early in fall or in spring, is not difficult; a mulching the first season after planting will be of much advantage to keep the roots from drying in summer and from frost in winter. Prop. usually by seeds sown in sandy, peaty soil in pans or boxes in early spring and kept in a cool frame or greenhouse. The seedlings should be pricked off as soon as they can be handled, and after they are again established gradually hardened off and the following year transplanted in frames or beds outdoors. Vars. of *K. latifolia* are usually increased by side-grafting on seedlings in the greenhouse or by layers, since it grows less readily from cuttings, while the other species may be prop. by cuttings of half-ripened wood under glass. Six species in N. Amer. and Cuba, allied to Rhododendron: fls. in terminal or lateral corymbs or umbels, rarely solitary; calyx 5-parted; corolla saucer-shaped or broadly companulate, 5-lobed; stamens 10, with slender filaments, the anthers held back in little pouches of the corolla, springing up suddenly and discharging the pollen if touched: ovary 5-celled, superior; capsule globular, parting into 5 valves, with numerous minute seeds. The lvs. of the Kalmias are said to be poisonous to animals, especially those of *K. angustifolia*. The flower of Kalmia is one of those proposed as a national flower emblem, especially on account of the exquisite symmetrical beauty of the single flower. It is a purely American genus, but unfortunately it is popularly known only in the eastern states.



1205. Kalmia latifolia (×½).

A. *Fls. in umbels or corymbs.*

B. *Lvs. evergreen.*

C. *Branchlets terete: lvs. pale green beneath.*

latifòlia, Linn. MOUNTAIN or AMERICAN LAUREL. CALICO BUSH. Fig. 1205. Shrub, 4–10 ft. high, rarely tree to 30 ft., with dense, round-topped head: lvs. petioled, alternate or irregularly whorled, oblong or elliptic-lanceolate, acute at both ends, dark green above, yellowish green below, 3–4 in. long: fls. in large, terminal compound corymbs on viscid peduncles; corolla rose-colored to white, with purple markings within, about ¾ in. across. May, June. New Brunswick to Fla., west to Ohio and Tennessee. B.M. 175. Em. 443. S.S. 5:236–237. A.F. 13:32. Gng. 3:1; 7:289. Gn. 22:343; 27, p. 549 & 33, p. 607.—Var. **álba**, Hort. Fls. almost white. Var. **monstruòsa**, Mouillef. (var. *polypétala*, Arb. Kew.). Corolla divided into 5 narrow petals. G. F. 3:453. Var. **myrtifòlia**, Rand (var. *nàna* or *minor*, Hort.). Lvs. small, 1–2 in. long, deep green, of slow growth, forming a low, dense bush. Var. **rùbra**, C. Koch (var. *Pavárti*, André). Fls. deep pink. R.H. 1888:540.

angustifòlia, Linn. SHEEP-LAUREL. LAMBKILL. WICKY. Shrub, to 3 ft.: lvs. usually in pairs or 3's, petioled, usually oblong, obtuse, light green above, pale beneath, 1–2½ in. long: corymb lateral, many-fld., compound or simple: fls. ⅓–½ in. across, purple or crimson. June, July. From Newfoundland and Hudson bay to Ga. B.M. 331. Em. 445.—There are vars. with light purple fls., var. **ròsea**, Hort.; with crimson fls., var. **rùbra**, Hort.; with ovate or oval lvs., var. **ovàta**, Pursh, and of dwarf habit, var. **nàna**, Hort.

CC. *Branchlets 2-edged: lvs. glaucous-white beneath, all opposite or in 3's.*

polifòlia, Wangh. (*K. glaùca*, Ait.). Low, straggling shrub, to 2 ft.: lvs. almost sessile, oval to linear-oblong, obtuse, revolute at the margins, ½–1½ in. long: fls. in simple terminal umbels, slender-pedicelled, ½–¾ in. across, rose-colored or purplish. May, June. Newfoundland to Pa. and in the Rocky Mts. from Sitka to Calif. B.M. 177. L.B.C. 16:1508. Em. 441. G.W.F.A. 18.—Var. **micrphýlla** is the alpine form of the Rocky Mts. growing only a few inches high and with very small lvs., ½ in. or less long. Var. **rosmarinifòlia** has narrow, oblong-linear, strongly revolute lvs.

BB. *Lvs. deciduous, alternate.*

cuneàta, Michx. Erect shrub, with slender, straggling stems, to 3 ft.: lvs. petioled, cuneate, obovate-oblong, acute or obtuse, pubescent beneath when young, ¾–1½ in. long: fls. slender-pedicelled, in few-fld. lateral umbels, creamy white with a red band within, ½–¾ in. across. June. N. C. and S. C. G.F. 8:435.

AA. *Fls. solitary, axillary: plant hirsute.*

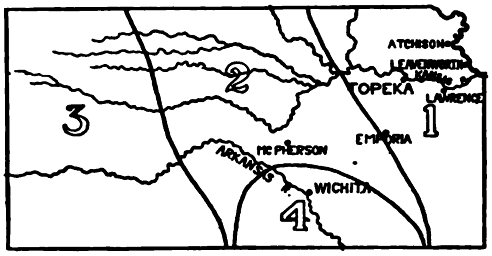
hirsùta, Walt. Low shrub, with many erect or ascending stems, to 1 ft.: lvs. almost sessile, oblong to lanceolate, ¼–½ in. long: fls. slender-pedicelled, ½ in. across, rose-purple; sepals oblong-lanceolate, hirsute, longer than the capsule. June. S. Va. to Fla. B.M. 138. L.B.C. 11:1058.

ALFRED REHDER.

KALOPANAX. See *Acanthopanax.*

KANSAS, HORTICULTURE IN. Fig. 1206. In 1854, when Congress passed a law opening this territory for settlement, it was considered as part of the great American desert, and it was almost universally thought to be fit only for grazing purposes. As to fruit-growing, such a possibility was not considered. This impression did much to retard tree-planting. Another great drawback was the fact that every settler planting fruit trees must have the favorite varieties of his former home grown. This resulted in the planting of over 2,000 kinds of apples alone. Few of these could be made to succeed, and, in time, so many failed that the impression was deepened that Kansas could not grow fruit. But amid these losses occasionally a man would succeed with some variety, and his success was heralded over the state until eventually the worthless kinds were weeded out and the road to success was perceived. Eventually the people could plant trees with some assurance that they would gather fruit therefrom. Since then, rapid progress in tree-planting has been made.

Apple trees do not bear heavy crops every year, but there has not been a total failure any year since the trees commenced bearing, some forty years ago. Peaches bear in some parts of the state every year, the south having few failures. Pears succeed throughout the state, although some varieties blight in some localities.



1206. Climatological regions of Kansas.

Plums and cherries are successful throughout the state, if the curculio is destroyed. Grapes bear heavy crops nearly every year. Strawberries yield good crops. Raspberries and blackberries also do well.

Market-gardening is profitably carried on around Kansas City, Leavenworth, Atchison, Lawrence, Topeka, Ft. Scott, Wichita, and many other towns. Sweet potatoes are at home here and are grown in large quantities. They are on the market from early in September to March and sometimes in May. Irish potatoes are not a sure crop on the uplands, but immense quantities are grown on the bottom-lands. Hundreds of car-loads are grown and shipped from the Kansas river bottom, between Topeka and Kansas City, every year.

The uplands are rolling prairies, with a deep, alluvial soil, with enough clay and sand intermixed to make it an ideal soil for fruit-growing. The subsoil is red clay, with some sand. This is underlaid with limestone from one to forty feet below the surface. This limestone is full of seams or cracks which afford a good subdrainage, so that little of the land needs artificial drainage. These lands, as above described, embrace a very large percentage of the entire state. The bottom-lands are wide, ranging from one to ten miles in width. These bottom-lands are composed largely of sand, with enough humus intermixed to make them very productive. They support some of the finest orchards.

Kansas City is the lowest point in the state, and is about 750 feet above the sea level. It gradually gets higher west, until it is over 4,000 feet on the western border. The rainfall is of the usual amount on the eastern border, but gradually decreases as the western boundary is approached.

Fred Wellhouse.

Kansas is, to the eye, practically level. There are no mountains within its boundaries, yet the eastern third is rolling. Some parts are rough, while the west is practically level, yet the state runs steadily up-hill from its eastern border, which is 750 feet above sea level, to the western limit, which is 4,500 feet above sea level. This naturally gives a varying climate. It is like climbing a mountain 3,750 feet high, and passing through the varying atmospheric changes as one goes upward, from a moist, easy-growing climate to a clear, windy, dry elevation 3,750 feet higher.

In the eastern third of the state (1, Fig. 1206) the apple and pear are at home, and when well grown are excellent. New varieties originating in the state or in the west are taking the place of eastern and imported varieties. Orchards and gardens are scattered all over the eastern half, and are very successful. The commercial horticulturist finds his early market in Nebraska, Colorado and Iowa; his later market in the cities and towns of Kansas, and a still later market in Texas, when the heat of summer has paralyzed Texan products. Oklahoma and the Indian Territory have for years been good markets for the southern part of Kansas. Many orchardists in the middle west sell every apple, good, [illegible] or indifferent, for cash to wagoners who come [illegible] the south and west annually in large numbers t[illegible]rry away the orchard products. Toward the west, ch[illegible]es, plums and peaches seem more at home. The two former are very prolific, and a success in the central part (2). Peach pits are planted in rows throughout the west for wind-breaks, and such trees bear considerable fruit, some of it very fine. Along the Arkansas river, where the roots of trees penetrate to water, all fruits do finely, and on irrigated lands back from the bottom-lands, horticulture prospers in all departments. The bluffs along the Missouri river, in the northeastern part of the state, seem peculiarly adapted to the apple, and it is grown there in immense quantities. Here are some of the greatest apple orchards of the world. The total number of apple trees in the state is 11,005,607; pears, 398,975; peaches, 5,734,337; plums, 919,527; cherries, 1,666,456. The acreage of vineyards is 6,543; of nurseries, 2,803; blackberries, 3,253; raspberries, 1,504; strawberries, 1,864 (1900).

Strawberries do well anywhere in the state. Some prominent varieties originated here. Raspberries are of easy culture. The "Kansas" originated in Lawrence, and has become the mainstay among blackcaps over a wide range. Blackberries are indigenous, and cultivated varieties mainly do well, though some of them rust badly. Raisin grapes are grown in the south by winter covering. Prunes and figs will also grow there. Vegetables of all kinds do well and are of fine quality, the tomato being especially at home. Early potatoes of the Kaw valley are widely known, and millions of bushels are exported yearly. Fertilizers are little used, and the stable manure of the cities is largely dumped on the commons. Only gardeners seem to value it. Melons are of easy growth, and of the finest quality. Sugar-beets have been tried at various points, but on analysis do not often come up to the required standard of saccharine qualities. Indian corn is the great staple, and all the sugar and popping varieties come to the finest maturity in quality. The lack of water in western Kansas (3) is the greatest drawback to agriculture there.

William H. Barnes.

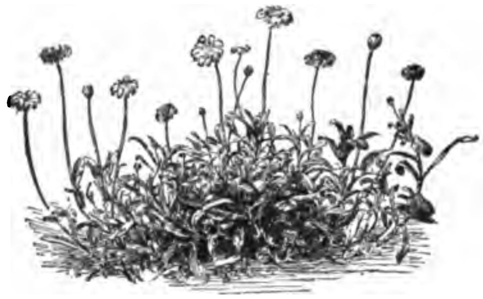
KARÀTAS (Brazilian name). *Bromeliàceæ.* Bentham & Hooker refer about 10 West Indian and Brazilian bromeliads to this genus, but Mez, the latest monographer (DC. Monogr. Phaner. 9), refers the species to other genera. Baker retains it. As understood by Bentham & Hooker, Karatas differs from Bromelia chiefly in its dense, capitate flower-clusters, which are sessile in the axils of the upper leaves. The species are cult. the same as Bromelia, Billbergia, and the like. They are little known in this country. Apparently the only common one is **K. spectábilis**, Ant. (*Nidulàrium spectábile*, Moore. *Regèlia spectábilis*, Linden. *Aregèlia spectábilis*, Mez). It is a stemless, tufted perennial, with broadly strap-shaped, spine-edged lvs., which are green above, gray-banded beneath and red-tipped at the end: fls. numerous, sunk amongst the lvs., the corolla with bluish lobes. Braz. B.M. 6024. L. H. B.

KARRI. *Eucalyptus diversicolor.*

1207. Charieis heterophylla. Natural size.

KAULFÚSSIA (G.F.Kaulfuss, professor of natural history at Halle). *Compósitæ.* A small, branchy, hardy annual, 6–12 in. high, with blue or red aster-like fls., on long stems: plant pubescent or hispid: lvs. oblong-spatulate or oblong-lanceolate, entire or remotely denticulate: heads many-fld., radiate, the ray fls. pistillate, the disk-fls. perfect: akene obovate and compressed, those of the disk with plumose pappus: involucre scales in two rows. **K. amelloides**, Nees (Figs. 1207–8), is an excellent annual, of easy culture in any garden soil. Var. **atroviolàcea**, Hort., has dark violet fls. Var. **kermesina**, Hort., has violet-red fls. Sow seeds where the plants are to grow; or they may be started indoors and the plants transplanted to the open. The genus Kaulfussia was founded by Nees in 1820. In 1817, however, the plant was described by Cassini as **Chárieis heterophýlla**, and this name should stand. S. Africa.

L. H. B.



1208. Charieis heterophylla, commonly known as Kaulfussia amelloides.

KENILWORTH IVY. *Linaria Cymbalaria.*

KENNÈDYA (Kennedy, of the nursery firm of Kennedy & Lee, important English nurserymen of the latter part of last century). *Leguminòsæ.* Australian woody trailers or twiners of about a dozen species, making excellent plants for the intermediate house or conservatory. Fls. red to almost black, pea-like: lvs. mostly pinnately 3-foliolate: standard orbicular or obovate, narrowed to a claw, and bearing minute auricles; wings falcate, joined to the keel; stamens diadelphous, — 9 and 1: pod linear, flattened or cylindrical, 2-valved, with pithy divisions between the seeds. Kennedyas are easily grown from cuttings of nearly ripe wood; also from seeds. They are mostly spring and summer bloomers, and should rest in winter. Give plenty of water during summer. They should be given support: they grow from 3-10 feet high, making stiff, woody stems. They may be trimmed back freely when at rest. The taller kinds, like *K. rubicunda* and *K. coccinea*, are excellent for rafters. Well-rooted plants may be planted permanently in the greenhouse border.

A. *Fls. nearly black.*

nigricans, Lindl. Twining, robust, somewhat pubescent: lfts. (sometimes reduced to 1) broad-ovate or rhomboid, entire, obtuse or emarginate: fls. slender, 1 in. or more long, in short one-sided axillary racemes, deep violet-purple or almost black: pod flattened. B.R. 20:1715. B.M. 3652.—*K. cærulea*, Hort., with blue fls., is perhaps this species.

AA. *Fls. red or scarlet.*

B. *Standard narrow-obovate.*

rubicúnda, Vent. Pubescent: lfts. 3-4 in. long, ovate to orbicular or ovate-lanceolate, entire: fls. dull red, drooping in racemes, usually not exceeding the lvs.; standard narrow-obovate, reflexed; wings narrow and erect: pod flat or nearly so. L.B.C. 10:954. B.M. 268 (as *Glycine rubicunda*). B.R. 13:1101 (as *Amphodus ovatus*).

BB. *Standard broad-ovate or orbicular.*

prostràta, R. Br. Prostate or twining, pubescent: lfts. broad-obovate or orbicular, less than 1 in. long, often wavy: stipules leafy, cordate: fls. 2-4 on each peduncle (which usually exceeds the lvs.), scarlet, ¾ in. long; standard obovate; keel incurved and obtuse; wings narrow and short: pod nearly cylindrical, pubescent. B.M. 270 (as *Glycine coccinea*).

Var. **màjor,** DC. (*K. Márryattæ*, Lindl. *K. Marryattiàna*, Hort.). Larger and more hairy: lfts. larger, strongly undulate: stipules sometimes 1 in. across: fls. large, deep scarlet. B.R. 21:1790. Gn. 28:501. A.F. 8:547.—A very handsome winter-flowering twiner.

coccinea, Vent. Densely pubescent: lfts. 3 or 5, ovate or oblong, very obtuse, often 3-lobed: stipules very small: fls. ⅓ in. long, scarlet, in long-peduncled clusters of 15-20; standard orbicular; keel very obtuse: pod flattened. B.M. 2664. L.B.C. 12:1126.—Known under several names, as *K. inophýlla*, Lindl., B.R. 17:1421; *K. dilatàta*, Cunn., B.R. 18:1526; *Zichya tricolor*, Lindl., B.R. 25:52; *Z. villòsa*, Lindl., B.R. 28:68, and others. Handsome slender twiner or trailer. L. H. B.

KENRICK, WILLIAM, was born in 1795, and was the oldest son of John Kenrick, one of the pioneer American nurserymen. His father commenced his nursery in the year 1790 on Nonantum Hill, near the line of the towns of Newton and Brighton, Mass., and on the very ground where the apostle Eliot began his labors for the Indians, under Waban, their chief. The raising of peach seedlings was the commencement of Mr. Kenrick's work. He soon acquired the art of budding, and thus offered named varieties for sale. In the year 1823 his son William became a partner in the nursery, and we find the first advertisement of the stock in the October number of the "New England Farmer" of that year. It named 30 varieties of finest budded peaches 5 to 8 feet high at 33⅓ cents each; 10 varieties of European grapes; 4 American: Isabella, Catawba, Bland and Scuppernong; currants, horse-chestnut, catalpa, mountain ash, lilacs, roses and a few other ornamental trees. It was stated that the trees would be packed with clay and mats. The son, William, appears to have assumed early control, having planted in 1823 two acres in currants alone. In 1824 they made 1,700 gallons of currant wine, increasing the amount to 3,000 gallons in 1825 and to 3,600 in 1826. Mr. Kenrick was an enthusiast in whatever he did, his extensive cultivation and introduction of the Lombardy poplar being an illustration of his sanguine temperament. A still more marked instance was his culture of the *Morus multicaulis* about the year 1835, and his advocacy of silk culture. For a time he found this to be a more profitable venture to himself than to his patrons. But it should be said that, however sanguine and confident were his opinions, they were honestly held and with no intent to mislead. In the year 1835 Mr. Kenrick published "The American Silk Growers' Guide," a small treatise on mulberry culture. In 1833 appeared the "New American Orchardist." This is a larger work, and is a full description of the fruits of that date. The author acknowledges his large indebtedness to other cultivators, especially to Mr. Robert Manning, of Salem, who published his "Book of Fruits" in 1838. Mr. Kenrick died in February, 1872. WM. C. STRONG.

KÈNTIA (after William Kent, horticulturist, companion of Reinwardt in journeys through the Indian archipelago). *Palmàceæ.* Spineless palms with pinnate lvs., sharp-pointed or 2-toothed, linear-lanceolate lfts., midnerves scaly beneath, and rachis angled above; petiole channeled above, rounded on the back. It differs from Areca in the sharply 4-angled branchlets of the spadices; and from Hedyscepe and Kentiopsis in having only 6 stamens. Species at most 6 or 7, from the Moluccas to northern Australia. The type is *K. procera*. Blume, from New Guinea, which is not cult. It is probable that none of the Kentias known to the American trade belong properly in this genus.

K. austràlis, Hort., from Lord Howe's Island, is probably one of the four following palms which, according to Maiden in Proc. Linn. Soc. N. S. W. 1898, are the only palms on that island: Clinostigma Mooreanum, Howea Belmoreana and Forsteriana and Hedyscepe Canterburyana. K. australis was int. 1873 and advertised 1893 by John Saul.—*K. Belmoreàna*, C. Moore=Howea Belmoreana.—*K. Baùeri*, Seem. = Rhopalostylis Baueri.—*K. Belmoreàna*, F. Muell. = Howea Belmoreana. — *K. Brównii*, Hort. Dedicated to D. S. Brown, of St. Louis, Mo. Resembles K. Macarthuri. Lvs. pinnate, arching: lfts. truncate and premorse. Very graceful. A.G. 15:266 and 20:223. This is, perhaps, Nenga or Hydriastele.—*K. Canterburyàna*, F. Muell.=Hedyscepe Canterburyana. — *K. divaricàta*, Planch. = Kentiopsis divaricata.—*K. Dumonidna*, Hort. Adv. 1895 by Pitcher & Manda. F.R. 1:379.—*K. élegans*, Brongn. & Gris.=Cyphophœnix elegans.—*K. exorrhiza*, H. Wendl.=Exorrhiza Wendlandiana.—*K. Forsteriàna*, F. Muell.=Howea Forsteriana.—*K. frutéscens*, Hort. Cult. by Siebrecht & Son.—*K. fulcìta*, Brong.=Cyphophœnix fulcita.—*K. grácilis*, Hort.=Microkentia gracilis.—*K. Kirsteniàna*, Hort. Lvs. very slender, dark green, arching, ascending, widely pinnated; lfts. broadly cuneate, shaped like a shark's fin, the truncate apex curiously erose, ragged, the upper margin extending into a long, sharp tip; petioles covered with light grayish brown pubescence. New Ireland. A.G. 20:223 (1899). G.C. III. 21:391. This is probably a Nenga.—*K. Líndeni*, Hort.=Kentiopsis macrocarpa.—*K. Lùciani*, Lind.=Kentiopsis macrocarpa.—*K. Macárthuri*, Hort. An elegant palm, with smooth, suberect lvs.; lfts. semi-pendulous, alternate, 4–8 in. long, ¼–1 in. wide, the midvein prominent above, obliquely truncate and ragged or premorse. Stems smooth, suckering quite freely. New Guinea. Int. 1878, Veitch & Sons. F. 1879, p. 115. Perhaps a Nenga.—*K. Mooreàna*, F. Muell.=Clinostigma Mooreanum.—*K. Mòrei*, Hort. Dreer. Possibly same as K. Mooreana.—*K. rubricaùlis*, Hort. Lvs. pinnate, ovate, with red petioles. Adv. 1895 by Pitcher & Manda.—*K. rupícola*, Hort. Adv. 1895 by Pitcher & Manda.—*K. Sanderiàna*, Hort. Very slender in habit, very hard foliage, spreading; lfts. very narrow, arranged on an arching rachis similar to Cocos Weddelliana. A graceful plant for jardinieres or conservatories. A.G. 20:223.—*K. Sápida*, Mart.=Rhopalostylis sapida.—*K. Van Hoùttei*, Hort.=Veitchia, sp. ? Adv. 1895 by Pitcher & Manda.—*K. Vèitchii*, Hort. probably=Hedyscepe Canterburyana.—*K. Wendlandiàna*, F. Muell.=Hydriastele Wendlandiana.

JARED G. SMITH.

KENTIÓPSIS (Greek: *like Kentia*). *Palmàceæ.* Spineless palms: lvs. equally pinnate; pinnæ subopposite, very coriaceous, narrow, sword-shaped, narrowed to the obtuse or toothed apex, with strong mid-nerve, prominent veins and thickened margins. Species 2. New Caledonia.

Kentiopsis belongs to a large group of genera mentioned under Hedyscepe (p. 718), which differ from Kentia in having the ovule fastened on the side of the locule, and more or less pendulous, instead of fastened at the base and erect, as in Kentia. Kentiopsis is distinguished from Hydriastele by having its fls. arranged spirally instead of in 4 ranks. From numerous other cultivated allies it is distinguished by the following characters: stamens numerous, 20–25: leaf-segments narrowed, obtuse or dentate: sepals of the staminate fls. triangular-orbicular, broadly overlapping.

macrocárpa, Brongn. (*Kéntia Líndeni*, Hort. Linden. *Kéntia Lùciana*, Linden). Rachis flat above, convex below. The form known as *Kéntia Luciani* has bright green lvs., tinged with brown on the under surface, the young petiole yellowish, later becoming brown. I.H. 29:451 and 24:276. F. 1884, p. 71. S.H. 2:117.—The species is distinguished by the reddish tinge of the young leaves.

K. divaricàta, Brongn. (Kentia divaricata, Planch.), is referred by Drude in Engler & Prantl, to Drymophlœus. It may be distinguished from the preceding by the alternate pinnæ and triangular rachis, keeled above. I.H. 28:409. This has been confused in the trade with Kentia gracilis, which is referred by Index Kewensis to Microkentia gracilis. See I.H. 23:245. Advertised 1895 by Pitcher & Manda.—*K. olivæfórmis*, Brongn., is characterized by the 4-angled rachis. Not cultivated.

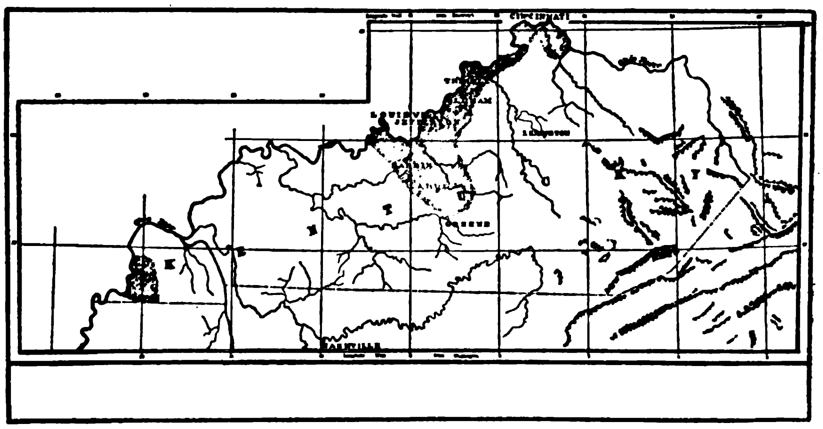
KENTUCKY HORTICULTURE. Fig. 1209. The state of Kentucky, while its interests have not been distinctively developed in the direction of horticulture, is, nevertheless, in its various parts, admirably adapted to nearly all the fruits and vegetables of the temperate zone. Its cultivation has been primarily that pertaining to general agriculture and stock-raising, rather than horticulture.

Before the civil war the people of wealth and culture, particularly over large areas through the central portion of the state, dwelt very largely in the country rather than in the towns, which at that time were nearly all small and comparatively unimportant. There are many evidences still remaining, in stately country homes surrounded by magnificent old trees and old-fashioned gardens, to bear witness to the high appreciation of the people of that period for the amenities of rural life. At that time commercial horticulture in the state was almost unknown; but with the steady advance in fruit-growing throughout the country, and with increasing facilities for rapid transportation for perishable products, there have been developed in recent years several well-defined fruit- and vegetable-growing areas, in which these industries have assumed large proportions.

The most important of these districts are two which lie respectively to the northeast and south of Louisville, and the boundaries of which, to some extent, overlap. The first of these is comprised largely of the counties of Trimble and Oldham. Trimble county is especially noted for its extensive peach orchards, which are situated upon the elevated lands adjacent to the Ohio river, much of the fruit being shipped by water to Louisville, Cincinnati, and other river towns. Oldham county has a large acreage of grapes. The first vineyards were established in the decade of 1850–60, of the Catawba and Isabella varieties. On account of the rot, the culture of these varieties was not very successful, but early in the next decade the Ives was introduced, and owing to its productiveness and shipping qualities, it has since been grown almost exclusively. The growth of the industry was quite steady until about 1890, when one or two seasons of large crops, accompanied by high prices, led to a very large increase in the acreage. During the past few years the business has been somewhat depressed, on account of the competition of earlier grapes from Georgia and other southern states.

To the south and southwest of Louisville lies the fruit district, known as Muldraugh Hill, a low, mountainous elevation, extending, in Kentucky, in a southeasterly direction from the Ohio river in Meade county, through Hardin, Larue, Green, and portions of adjacent counties. In this hill country fruit-growing is most largely developed on its southern slope, peaches and apples holding the first place in importance, while pears, plums and the small fruits are also extensively grown. This locality seems peculiarly adapted to the apple and peach, orchards of the latter having produced, according to good authorities, nineteen paying crops in twenty-three years, with comparative freedom from disease, and attaining, when permitted, a great age and size. The fruit from this district is shipped to various points in the Mississippi valley, but especially to such northern cities as Indianapolis and Chicago, where it holds high rank.

Between and connecting the two fruit districts mentioned is the county of Jefferson, containing the largest city in the state—Louisville. In this county fruit-growing and market-gardening are very extensively developed, particularly for the local market, and here also are found the most extensive florists' establishments in the state, as well as many forcing-houses, devoted to growing winter vegetables, chiefly lettuce.



1209. Kentucky. Shaded areas designate pomological districts.

Throughout much of the fruit districts mentioned, as in many other parts of the state, the favorable results secured in fruit-production are possible largely on account of the immunity from late spring frosts, due to elevated locations and to the deeply eroded river channels, which afford abundant cold air drainage.

In the extreme southwestern corner of the state (near K in Fig. 1209), in the counties of Carlisle, Hickman and Fulton, a combination of favorable conditions has led to an extensive development of the trucking and small fruit interests. Chief among these conditions are a fertile soil, a warm spring temperature, and direct and rapid transportation, both by water and rail, to northern cities. Many hundreds of acres of strawberries are grown, and the production of beans, spinach, melons and other garden crops is of nearly equal importance.

In the vicinity of Cincinnati, Ohio, the fruit and vegetable-growing interests are quite extensive, although the conditions for market-gardening have led to a greater development of that business upon the northern than upon the Kentucky side of the Ohio river.

About two-fifths of the eastern portion of Kentucky, comprising the mountainous part of the state, is still sparsely settled, its agriculture is confined to a few staple crops produced, in many cases, by primitive methods, and true horticulture is comparatively unknown over a great part of this vast area, although, as shown in isolated localities, nearly all our fruits and vegetables can be grown with perfect success. Within the borders of this mountain region, in the southeastern part of the state, are several prosperous German and Swiss colonies, nearly every member of which, with characteristic industry and thrift, has possessed himself, on some part of his farm, of a vineyard and orchard, and so produces an ample supply of the best fruits. Here and there in other localities, enterprising individuals have demonstrated the easy possibility of producing orchard and garden products without stint; but the average farmer of the mountain region, as too often elsewhere, is apparently content to let his table remain bare of the best fruits and vegetables, as his home surroundings are so often bare of trees and flowers.

The public parks of the state are confined almost exclusively to those of the city of Louisville, which was itself without any park system until recent years. After the passage of an act providing for their establishment, a board of park commissioners was elected in 1890, since which time the development of the park system has been vigorously prosecuted. At the present time there has been secured for this purpose a splendid public possession of over 1,100 acres, composed of Iroquois park, 589 acres; Cherokee park, 304 acres; Shawnee park, 167 acres; and the southern parkway, 48 acres, together with a number of small city squares. These parks are being improved under the direction of the most skilful landscape architects, and promise soon to bring the city of Louisville to an equality in this respect with other great cities of the country.

Of other public grounds in which the work of the landscape horticulturist is manifest, the two cemeteries, Cave Hill, of Louisville, and that of Lexington are perhaps the most notable examples in the state. The former comprises an area of about 300 acres, and is situated upon a beautiful tract of land, elevated 100 feet above the Ohio river. It contains several beautiful lakes, and is especially rich in its collections of aquatics.

The cemetery at Lexington contains over 100 acres, and was established in 1849. It is exceptionally fortunate in having been under the same superintendent during its entire history of almost fifty years, and in having the landscape method of treatment followed from the first. Among many interesting horticultural features, the most notable to-day are the magnificent old bur oaks and white elms, many of which are 4 or 5 feet in diameter. CLARENCE W. MATHEWS.

KENTUCKY BLUE GRASS. *Poa pratensis.*

KENTUCKY COFFEE TREE. *Gymnocladus Canadensis.*

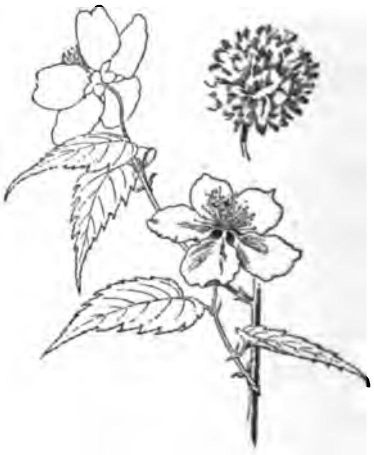
KÉRNERA. *Cruciferæ.* Under this name amateurs cultivate a rock plant growing about 4 in. high, which blooms profusely all summer, its fls. being small, white, and borne in elongated umbels. It should probably be known as *Cochlearia saxatilis*. Four genera, representing 4 orders, have been named after Johann Simon von Kerner, 1755–1830, Prof. of Botany at Stuttgart. Bentham and Hooker regard the cruciferous Kernera as a subgenus of Cochlearia, in which the stamens are longer and bowed at the apex: pods turgid; valves very convex: cotyledons accumbent or incumbent.

The following species is a compact, branching, neat habited plant thriving in any light soil that is moderately rich. It requires a sunny but not too dry situation. Prop. by cuttings, division or seed.

K. saxátilis, Reichb. Properly Cochlearia saxatilis, Linn. Root-lvs. oblong, dentate, pilose: stem-lvs. linear-oblong: petals 4, obovate, 2–3 times as long as the calyx: seeds numerous, not margined. Eu. J. B. KELLER and W. M.

KÉRRIA (after William Kerr, a gardener who introduced this and many other plants from China; not J. Bellenden Ker or M. Kerr, as often stated). *Rosàceæ.* A monotypic genus, one of the first shrubs brought from Japan; best known by its weak, slender green branches, slender irregularly toothed lvs. and large yellow fls. It grows 4–8 ft. high and as broad as high, with numerous short-branched, spreading stems, attractive in winter from its light green branches, in early June when its blossoms appear in greatest abundance; in November, when the lvs. are of a clear yellow, and is not unattractive throughout the whole year. It is a refined plant and deserves free use in ornamental planting, either in simple masses or at the front of a shrubby group or border. It is not thoroughly hardy in all situations in the northern states, the tips of its branches often winter-killing, which causes it to demand a well-drained and partially sheltered position. It grows in any good garden soil. Although enduring sunlight, it is best in partial shade, since the intensity of full sunlight partially bleaches the fls. It is prop. by cuttings, layers and root divisions.

Japónica, DC (*Córchorus Japónicus*, Thunb.) GLOBE FLOWER. JAPANESE ROSE. Fig. 1210. Lvs. simple, alternate, ovate-lanceolate, acuminate, largely unequally serrate, 1–2 in. long, clear green above, pale below, thin, slightly pubescent: fls. abundant, solitary, terminal, peduncled, 1–2 in. in diameter, appearing in June and more or less throughout the year; calyx persistent, 5-lobed; petals 5, large, yellow, ovate; stamens numerous: carpels 5–8, globose, distinct. A.G. 18:425. F.E. 9:593. R.H. 1869, p. 293. S.B.F.G. II. 337. Gn. 21, p. 275.—Var. **flore plèno**, double, more vigorous and more frequent in culture than the single. B.M. 1296. Var. **grandiflòra**, a vigorous form with large fls. Var. **aureo-vittàtis** (*rumulis variegatis aureis*), a dwarf form, the branches striped with yellow and green. Var. **argénteo-variegàta**, 2–3 ft. high, with small green lvs. edged with white. A. PHELPS WYMAN.



1210. Kerria Japonica.
Showing single and double flowers (× ½).

KIDNEY BEAN. Common name in England for the common beans in distinction from the Lima bean, the former being *Phaseolus vulgaris*, the latter *P. lunatus*.

KIDNEY VETCH. See *Anthyllis*.

KINGNUT. *Carya sulcata*.

KIN-KAN. See *Kumquat*.

KINNIKINNICK. Dry bark of *Cornus Amomum*, smoked by western Indians.

KITCHEN GARDEN. See *Vegetable Gardening*, *Gardens*, and *Horticulture*.

KLEINIA. Of the 3 genera of Compositæ of this name, 2 are referred to Porophyllum and Jaumea, but the trade names will be accounted for under *Senecio*.

KNAPWEED. See *Centaurea*.

KNIGHT'S STAR. *Hippeastrum equestre*.

KNIPHÒFIA (Johann Hieronymus Kniphof, 1704-1765, professor at Erfurt). *Liliàceæ*. This genus includes the Red-hot Poker Plant (Fig. 1211), which is unique in its appearance and one of the most striking plants in common cultivation. No one who has ever seen its pyramidal spike of blazing red fls. borne in autumn is likely to forget when and where he "discovered" this plant. It is herbaceous and nearly hardy N., has sword-shaped lvs. 2-3 ft. long, and several scapes 4 or 5 ft. high surmounted by a spike 4-8 in. long composed of perhaps 100 tubular, drooping fls., each 1 in. or more long, and fiery, untamed red. A sky-rocket is not more startling. By far the commonest species is *K. aloides*, which has perhaps a dozen varieties with Latin names and twice as many with personal names. All the other species have much the same general effect, and are of interest chiefly to collectors and fanciers. Poker Plants are hardy south of Philadelphia when well covered in winter, but in the North it is generally safer to dig up the plants in November, place them in boxes with dry earth, and store them in a cellar in winter. In spring place them in a warm, sheltered, well-drained spot, preferably with a background of shrubbery to set off the flowers.

The genus is confined to Africa and Madagascar, and all but two of the species numbered below are from south Africa. The plants seem to be still better known to the trade as species of Tritoma, but the following account omits most of such synonyms. Bentham and Hooker placed Kniphofia between Funkia and Notosceptrum. The latter genus is not in cultivation, and Funkia has blue or white fls., which colors are not found in Kniphofia. Poker Plants have fls. of red, orange or yellow. Blandfordia has similar colors and agrees in having pendulous tubular fls. with short lobes, and also long, narrow lvs., but the stamens are fixed at the middle of the tube, and the capsule has septicidal dehiscence, while in Kniphofia the stamens are fixed under the pistil and the capsule has loculicidal dehiscence.

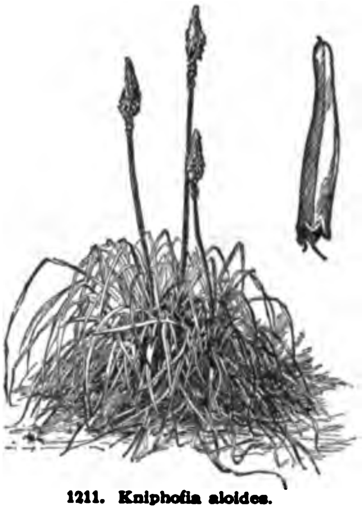
Kniphofias are often classed by dealers as bulbous plants, though they have only a short rhizome and numerous, clustered, thickish root-fibers. Baker speaks of the "raceme" of a Kniphofia, but the pedicels are so short that the inflorescence is here spoken of as a "spike," particularly as a spike signifies to the popular mind a denser inflorescence than a raceme. Most of the species have been very recently monographed by Baker in Flora Capensis, vol. 6 and Flora of Trop. Afr. vol. 7. When the height of the plants is given below, it refers to the height of the scape.

Index of names exclusive of those in the supplementary lists (varieties and synonyms in italic):

aloides, 1.
Burchelli, 3.
carnosa, 1.
caulescens, 6.
comosa, 10.
coroniánum, 5.
corallina, 5.
glaucescens, 1.
grandiflora, 1.
grandis, 1.
Leichtlinii, 9.
Macowanii, 5.
Nelsoni, 4.
nobilis, 1.
pauciflora, 8.
Rooperi, 2.
Saundersii, 1.
Tuckii, 7.

A. *Length of perianth 1 in. or more.*
  B. *Stemless or nearly so.*
    C. *Form of lvs. sword-shaped-acuminate.*
      D. *Color of lvs. dull green.*
        E. *Width of lvs. ¾-1 in* ...... 1. **aloides**
        EE. *Width of lvs. 1½ in* ...... 2. **Rooperi**
      DD. *Color of lvs. bright green* .... 3. **Burchellii**
    CC. *Form of lvs. linear.*
      D. *Width of lvs. one-sixteenth to one-twelfth of an inch* ...... 4. **Nelsoni**
      DD. *Width of lvs. one-eighth to one-sixth of an inch* ...... 5. **Macowanii**
  BB. *Stem 6-12 in. long* .... 6. **caulescens**
AA. *Length of perianth ½-¾ in.*
  B. *Form of perianth subcylindrical* .. 7. **Tuckii**
  BB. *Form of perianth funnel-shaped.*
    C. *Width of lvs. one-eighth to one-sixth of an inch* .... 8. **pauciflora**
    CC. *Width of lvs. ½ in.*
      D. *Stamens 1½ times as long as the perianth* .... 9. **Leichtlinii**
      DD. *Stamens twice as long as the perianth* .... 10. **comosa**

1. **aloides**, Moench (*K. Uvària*, Hook. *Trìtoma Uvària*, Ker.). RED-HOT POKER PLANT. POKER PLANT. TORCH LILY. FLAME FLOWER. Fig. 1211. Lvs. slightly glaucous, 2-3 ft. long, scabrous on the margin, acutely keeled, with 30-40 close vertical veins: raceme dense, often 6 in. long, 2½-3 in. thick: upper fls. bright red, lower ones yellow; perianth cylindrical; stamens sometimes barely exserted. F.S. 13:1393. B.M. 4816:758.—The following varieties with Latin names are in the trade and usually advertised as apparent species under Kniphofia or Tritoma. They may be all more or less distinct horticulturally. An everblooming kind is advertised in 1900 and said to flower from June to Dec. Var. **carnòsa** is figured in Gn. 19:286 with the fls. opening from the top instead of the bottom, and with red filaments and yellow anthers. Leichtlin introduced it about 1881 and said it grew 1½-2 ft. high, the apricot-red of the fls. toned down by a glaucous bloom. Var. **floribúnda** is early-flowering, says Van Tubergen. Var. **glaùca** is less known than the next. Var. **glaucéscens** is figured in Gn. 36:727 with a spike 9 in. long, of "vermilion-scarlet fls. changing to a more orange color. One of the freest bloomers. Int. 1859." Foliage somewhat glaucous. Var. **grandiflòra**, one of the earliest improvements on the type. John Saul said it grows 2-3 ft. high. Var. **grándis**. "The largest-flowered of all; fls. red and yellow, 5 ft." *Woolson*. Referred by Kew authorities to var. maxima. Var. **nòbilis** is said by Carrière, R.H. 1885:252, to have



1211. Kniphofia aloides.
Separate flower natural size.

shorter and stricter lvs. than Saundersii, the spikes more ovoid, the fls. uniformly red and less deflexed. Lvs. not glaucous. Gn. 55, p. 167. Var. **Saùndersii**, in R.H. 1882:504, is shown with "red-orange fls." in an elliptical spike and said to grow 6 ft. and more high. Woolson finds it grows 4–6 ft. high in rich soil, with cylindrical spikes 18–24 in. long and fls. often ½ in. across. Var. **serótina** is a late-fld. form.

Baker's treatment of the varieties is as follows:

Var. **máxima**, Baker (*K.* and *T. grandiflòra*, Hort. *T. Saùndersii*, Carr.). More robust: lvs. 4–5 ft. long, 1 in. wide: raceme and fls. longer: stamens more decidedly exserted. B.M. 6553 (fls. yellow, more or less tinged red). R.H. 1882:504 (colored like the type).

Var. **nóbilis**, Baker (*T. nóbilis*, Guill.). Still more robust: scape including raceme sometimes 6–7 ft. long: fls. 1½ in. long. R.H. 1885:252.

Var. **serótina**, Hort. A late-flowering form with slender perianth 1¼ in. long and distinctly exserted stamens. Baker also mentions varieties **carnosa** and **glaucescens** without discrimination. Other varieties with Latin names are mentioned in Gn. 36: 727.

2. **Hoòperi**, Lem. Lvs. 4 ft. long, scabrous on the margin, glaucous. Later-fld. than No. 1: fls. paler. B. M. 6116.

3. **Búrchellii**, Kunth. Lvs. 2–3 ft. long, ½–¾ in. wide, smooth on the margin: spike 6–12 in. long: fls. bright yellow, much tinged with red when young. "A much dwarfer plant than No. 1 and for many purposes equally desirable. Height 1½ ft. Fls. tinged green." *J. B. Keller.*

4. **Nélsoni**, Mast. Lvs. 1½–2 ft. long, with a thick midrib and recurved serrulate edges. G.C. III. 11:561. Gn. 50, p. 400; 55:1213 (brick-red, no trace of yellow).

5. **Macówanii**, Baker. Lvs. with a thickened scabrous margin, many upper fls. bright dark red. B.M. 6167. R.H. 1879:390.—"A very neat dwarf species with orange-scarlet fls. in early autumn, 1–2 ft." *Woolson. K. corallina*, Hort., R.B. 19:25 (1893), a hybrid between this species and *K. Uvaria*, was raised by Deleuil, of Marseilles. Woolson says it grows 18–24 in. high and bears ovoid spikes of coral red fls. all summer and fall. He says it is good for cutting. *K. corolinianum* of one of our nursery catalogues is presumably an error for *K. corollina. K. mèdia Macówanii*, Hort. "A hybrid between *K. aloides grandiflora* and *K. Macowanii*. This is an earlier blooming sort than either of its parents, as dwarf as Macowanii and much earlier and more brilliant. Thoroughly tested." *Woolson.*

6. **cauléscens**, Baker. Lvs. sword-shaped-acuminate, broadly channelled, not acutely keeled on the back, 4–5 ft. long, 5–6 in. wide, margin serrulate: spike over 1 ft. long, 3 in. thick: lower fls. yellow, upper ones red. G. C. III. 6:564. R.H. 1887:132.—This differs from all described above in having stamens much exserted. Gn. 41:861 is perhaps the most artistic of all colored plates of Kniphofias.

7. **Túckii**, Baker. Lvs. ensiform (linear in Nos. 8–10), 1–1½ ft. long, ¾ in. wide, margin serrate: spike very dense, 5–6 in. long: fls. yellow, tinged bright red when young. One of the hardiest.

8. **pauciflòra**, Baker. Lvs. 1–1½ ft. long, margin smooth: raceme lax (dense in Nos. 9–10), 2–3 in. long: fls. pale yellow; stamens shortly exserted, as in No. 7. G.C. III. 12:65 shows it with only 25 fls. and the loosest raceme of any species here described.

9. **Leichtlinii**, Baker. Fls. bright yellow; perianth more narrowly funnel-shaped than in No. 10, becoming ¾in. long: scape speckled with red, sometimes bearing a bract 4–5 in. long. This and No. 10 are from tropical Africa; the rest from South Africa. B.M. 6716. R.H. 1884, p. 557. Var. **distàchya**, Baker, has a forked scape and small accessory lateral raceme.

10. **comòsa**, Hochst. Fls. bright yellow, dilated suddenly at the middle, ½ in. long; filaments red; anthers yellow. B.M. 6369.—This has relatively longer stamens than any other species and is perhaps more conspicuous by reason of its mass of stamens than the outline of the spike. One of the tenderest.

Supplementary list of imperfectly known Latin names representing kinds now advertised in America: *K. hýbrida*, Hort., is a trade name used to include varieties with personal names, of miscellaneous or unknown parentage.—*K. mutábile*, Hort. "Height 5–6 ft." *Woolson.*—*K. Pfitzerii*, Hort. John Saul, 1893, said "rose-scarlet without a trace of yellow." Dreer, 1900, says it is a great improvement of K. aloides, var. grandiflora, the scapes more numerous, often 4½ ft. high: spikes over 12 in. long: fls. rich orange-scarlet, shading to salmon-rose at the edge.—*K. speciòsa*, Hort. Van Tubergen.—*K. Woódii*, Hort., is advertised by Franceschi, who says it comes from Natal, and has lemon-yellow fls. Not in Flora Capensis.

Twenty-five varieties with personal names are advertised by Van Tubergen and Krelage. How much variation in habit and season of bloom does not appear. The color-range is about as follows: dark brick red, carmine-red, coral red, scarlet-orange, orange, bronzy yellow, deep yellow, pure yellow and primrose- or straw-colored. The filaments may be red or yellow, the anthers apparently sometimes differently colored from the filaments. Some hybrids are recorded, and some form of K. aloides is usually concerned.

W. M.

KÒCHIA (after W. D. J. Koch, 1771–1849, professor of botany at Erlangen; wrote a flora of Germany and Switzerland). *Chenopodiàceæ.* This includes a plant treated as a hardy annual which is called the Mock Cypress or Summer Cypress. J. Wilkinson Elliott says, "It grows 2–2½ ft. high, resembling a small, closely sheared evergreen, the foliage being light green until September, when the whole plant is a solid mass of crimson. The fls. are minute but countless. The plant dies within two weeks after blooming. It germinates very quickly, even in the warm spells of late winter." Elliott called it the Mexican Fire Plant, because the seeds were procured in Mexico. However, the genus has no species native to the western hemisphere. It is probably this same plant which is advertised by Bridgeman as *Belvidere Kochia*. There is no genus called Belvidere. The French popular name for this plant is Belvedere, and it is a native of Europe and northern Asia. Bridgeman, however, says the fls. are yellow, and gives the height as 3 ft., while Voss (Vilmorin's Blumengärtnerei) says it is 3–5 ft. high or more. Voss advises a clay soil and sunny position, and since it likes a salty soil recommends that about an ounce and a half of saltpetre be sprinkled over each square yard of soil. This plant is used abroad as a "foliage plant," because of the vivid color of the whole plant from July to September.

The seed may be sown indoors in April, and the plants set out in May, or the seeds may be sown in the open ground about May 1. The plants should stand about 2 ft. apart.

Kochia is a polymorphorus genus of abont 30 species of herbs which are often woody at the base: lvs. often minute and narrow, alternate, more or less silky, rarely glabrous: fls. small or minute, sessile, solitary or clustered in the axils of the lvs.; calyx enlarging into a flask-shaped body, which incloses the fruit; perianth orbicular; lobes 5, incurved and bearing horizontal wings on the back or on the tube which are membranous or scarious, distinct or confluent; stamens 5; filaments short or long and compressed; stigmas 2, rarely 3.

scopària, Schrad. MOCK CYPRESS. SUMMER CYPRESS. Erect, much-branched, densely pyramidal: branches striate, slender, and close to the main stem: lvs. linear-lanceolate, ciliate, 2–3 in. long, 2–4 lines wide: fls. inconspicuous, green; perianth in fruit provided with very short, triangular, pointed appendages.

KŒLÈRIA (Georg Ludwig Kœler, professor of natural history at Mainz, published in 1802 a description of the grasses of Germany and France). *Gramineæ.* This includes a tufted, perennial grass sometimes offered by collectors of native plants. Wilfred Brotherton suggests its cultivation for ornament in dry, silvery-sand. It is a very variable plant, growing 1–2½ ft. high, erect and unbranched, and has shining spikes. The genus contains about 15 widely scattered species, and its nearest cultivated allies are Eatonia and Molinia, which are discriminated elsewhere. Important generic characters are the spicate panicles, which are cylindrical or somewhat interrupted: flowering glumes more or less hyaline-scarious, blunt, or tipped with a mucro or rarely a short awn.

cristàta, Pers. Stems rigid, pubescent just below the panicle: sheaths often shorter than the internodes, smooth, scabrous or hirsute: lvs. 1–12 in. long, flat or involute: spikelets 2–5-fld. July–Sept. Widely distributed in N. Amer. in sandy and prairie soil. B.B. 1:194.

W. M.

KŒLREUTÈRIA (Joseph G. Kœlreuter, 1733–1806, professor of natural history at Karlsruhe). *Sapindàceæ.* An arborescent genus of about 3 species occurring in China and Japan, one of which is *K. paniculata*, a medium-sized, irregular, round-headed tree, 25–30 ft. high, with large, compound, irregularly toothed lvs., yellow fls. in July and large, bladdery fruits in panicles in autumn. It is hardy in Mass., although single limbs are occasionally killed back in winter. It also endures dry weather and hot winds in the West. It is of easy culture, but requires a fairly rich soil. As an ornament it may be used as a single specimen, though not a particularly refined tree, or it may be mixed with other genera in the woody border. It is prop. by seeds, which it ripens early and freely, by layers in autumn, by cuttings of the young branches in spring, and by root-cuttings.

paniculàta, Laxm. (*Sapindus Chinénsis*, Murr.). VARNISH TREE. Lvs. deciduous, alternate, 12 in. long, unequally pinnate, without stipules; lfts. ovate, largely and irregularly dentate, glabrous, in 4–7 pairs, opposite and alternate: fls. yellow, ½ in. long, in large, upright, terminal, many-fld. panicles; sepals 5; petals 3–4, hypogynous, irregular, each claw with a scale-like appendage, the disk enlarging before each petal; stamens 5–8: ovary oblong, pubescent, becoming a 3-lobed, 3-celled bladdery, inflated, triangular pod, 1½–2 in. long, usually red, becoming brown, borne in large, erect panicles. G.C. III. 2:561. Gng. 2:353 and 8:219. Gn. 32, p. 378.

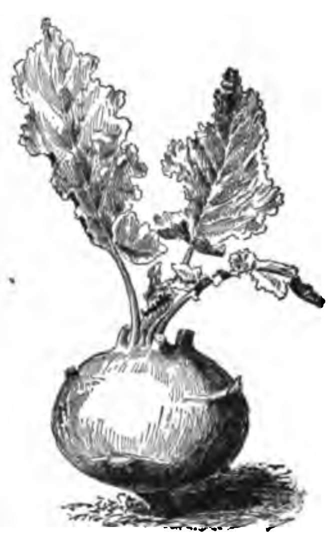
K. bipinnàta, Franch. A vigorous tree, 60 ft. high, with doubly pinnate lvs. over 2 ft. long, growing in W. China. R.H. 1888, p. 393. Gn. 34, p. 305.—*K. Japónica*, Sieb. A more branched form with deeply cut lvs. and smaller fruit, but not specifically distinct from K. paniculata.

A. PHELPS WYMAN.

KŒNIGA. See *Alyssum.*

KOHLRABI (*Brassica oleracea*, var. *caulo-rapa*). Fig. 1212. This plant exhibits a remarkable variation from the normal form of the specific type, as represented by the cabbage. A prominent writer on vegetables, referring to the botany of the plant, says: "It comes between the cabbage and turnip." Had this reference been made to the edible portion it would be literally true. In the turnip the edible part is the swollen root; in the cabbage it is the fleshy and tightly curled leaves, while in the Kohlrabi it is the globular enlargement midway between root and top. This plant is mainly grown for cattle food. It is but little known in America. In France and Germany its usefulness is generally recognized. In Italy the partially developed stems are used as substitutes for cauliflower and cabbage. It is not likely that as a cattle food it will grow in popularity in this country, as rape is better adapted for sheep-grazing purposes, and turnips can be grown with equal ease and kept through winter with greater satisfaction. Its treatment in the garden is essentially that of early cabbage. The plants are very hardy. For very early crop it is desirable to start them in a hotbed. If properly hardened off, they may be set out as soon as the frost is out of the ground. Plant and cultivate like early cabbages. The seed of main field crop may be sown directly in the hill. The rows should be 2½ ft. apart, and the hills 2 ft. apart in the row. Several seeds are planted in each hill, and all plants pulled out but one, after danger of destruction by flea-beetle is over. Many growers in the western states follow this plan in growing late cabbages, as well as kale and brussels sprouts. The seed may be planted, according to locality, from May 10 to June 20. When the plants are grown in the seed bed the treatment is essentially the same as that described under *Cabbage.* In northern regions, only the early varieties should be grown on account of the slowness of the plant in maturing. No special effort seems to have been made to develop many distinct varieties of Kohlrabi. The two leading types are the Purple and the White Vienna, which mature sufficiently for table use in 2½–3 months from time of sowing seed; the common white requires 3–4 months to reach edible size, and much longer to attain maturity. Where corn is largely grown as a cattle food, the culture of Kohlrabi is not likely to extend. Vilmorin describes Artichoke-leaved and Neapolitan. Other varieties are Erfurt, Goliath, Green, Imperial, Late Purple, Purple Vienna, Short-leaved Vienna, White Forcing, and White Vienna. Persons who like turnips will also like Kohlrabi. The almost universal error in using it is to allow the tubers to get too large. When they are partially grown they are soft and palatable. Cabbage worm and clubroot are the most important enemies. Consult, also, *Brassica* and *Cabbage.*

JOHN CRAIG.



1212. Kohlrabi

Kohlrabi may be grown, bunched and put on the market in exactly the same manner as early table beets are handled. In our eastern cities, where the population consists to a large extent of people of German extraction, Kohlrabi for table use is in good demand, or such a demand is easily cultivated. We find it an easy crop to grow, and invariably profitable, simply because few gardeners make a specialty of it. As early in spring as the ground can be brought into best shape, sow seed in rows with the drill, the rows to be about 18 inches apart, and afterwards thin the plants to stand 4 to 6 inches apart in the rows. Begin pulling and bunching when the bulbs have attained a size of 2 to 3 inches in diameter. Make successional sowings to keep up a continuous supply of the tender bulbs. They grow tough when nearing full development and maturity. Plants often winter well on their summer stems, and seed may be grown from them.

T. GREINER.

KOLA. See *Cola.*

KONJAK. See *Conophallus Konjak.*

KRAÙSSIA (C. F. F. Krauss, of Stuttgart, collected plants at the Cape, and wrote on South Sea corals). *Rubiàceæ. K. lanceolata* is a shrub cultivated in southern Florida, bearing small white fls. in axillary, many-fld. cymes ½ in. or more long. *K. coriacea* of the trade will be found under Tricalysia, an allied genus, in which the fls. do not have a densely bearded throat, as in Kraussia, but are quite glabrous. Kraussia has 3 species of shrubs from the Cape of Good Hope: lvs. opposite, short-stalked, entire, leathery, elliptical or lanceolate: stipules short, persistent, grown together into a small cup: corolla broadly funnel-shaped; lobes 5: ovary 2-celled: berry pea-shaped, 1–3-seeded. E. N. Reasoner writes that the Kraussias have been frozen so many times in Florida that he has never seen them in flower.

lanceolàta, Sond. Branches yellowish, 4-grooved: lvs. lanceolate, acuminate, 3–3¼ in. long, 8–10 lines wide: filaments exserted, nearly as long as the anthers: stigma 2-cut, one-third as long as the style.

KRÍGIA (David Krig or Krieg, an early collector in Maryland and Delaware). *Compósitæ.* Five species of hardy herbaceous plants, annual and perennial, yellow-fld. and sometimes called "Dwarf Dandelions." They differ from the common dandelion in having a pappus composed of both chaff and bristles, instead of bristles alone. They are natives of the Atlantic states. Three perennial species are cult. by dealers in native plants. These have heads about 1 in. across and 15–20 pappus bristles. Unlike the common dandelion, these plants do not become weedy.

A. *Stem a leafless scape, bearing 1 head.*

B. *Has tubers.*

Dandelion, Nutt. Height 6–18 in.: lvs. lanceolate or almost linear, varying from minutely toothed to pinnatifid. Apr.–June. Moist ground, Md. to Fla. and Tex. —The only kind that has tubers.

BB. *Has no tubers.*

montàna, Nutt. (*K. Dandelion*, var. *montana*, Chapman). Height 9–12 in.: lvs. oblong to linear, varying from entire to pinnatifid: head smaller than in *K. Dandelion*. Crevices of rocks, Alleghenies, N. and S. Car. and Ga.—Harlan P. Kelsey writes that this is an admirable rock plant, thriving in any soil or situation, and blooming profusely from March to June or July. Prop. by seed or division.

AA. *Stem 1–3-lvd., branched above, bearing 2–6 heads.*

amplexicaùlis, Nutt. (*Cýnthia Virgínica*, Willd.). Height 12–24 in.: lvs. oblong or oval, obtuse, entire or repand and denticulate, or the root-lvs. somewhat lyrate; stem-lvs. partly clasping. May–Oct. Moist banks, N. Y. to Ga., west to Colo.

KRYNÍTZKIA (Prof. J. Krynitzki, of Cracow). *Boraginàceæ.* Chiefly North American herbs, annuals and some perennials, with small fls. nearly always white. Two species have been listed in eastern catalogues, and are procurable from western collectors. The following descriptions give some idea of what the plants are like, and for specific distinctions from numerous allies the student is referred to Gray's "Synoptical Flora."

glomeràta, Gray. Biennial, coarse, grayish prickly-hirsute, 1–3 ft. high: lvs. spatulate or linear-spatulate: fls. white, thyrsoid-glomerate. Plains, along eastern base of Rocky Mountains.

barbígera, Gray (*Eritríchium barbígerum*, Gray) Hispid and hirsute, 9–12 in. high: lvs. linear: fls. white in solitary or panicled, elongating spikes. S. Calif.

KUDZU VINE. *Pueraria Thunbergiana.*

KUMQUAT or **KINKAN,** of the Japanese, is a dwarf member of the citrous tribe (*Citrus Japonica*), seldom growing more than 6 or 8 ft. high on the most vigorous stock, and when worked on a dwarf stock making but a good-sized bush; but no matter what its size may be, it freely produces very pretty golden yellow fruit, which is very palatable either in a fresh state or preserved. The plant may be budded or grafted on any citrus stock—orange, lemon, lime, etc.—but is most commonly worked on *Citrus trifoliata*, making but a bush, eminently adapted for growing in restricted places, both in- and outdoors. As a pot-plant for the house it is a gem, making a very handsome evergreen bush and blooming freely through the spring or early summer, then setting its interesting fruit. The flowers are much like the orange, white and scented, but smaller. The soil best adapted to the Kumquat is a light loam or sand; it thrives in any soil suited to the orange or lemon.

1213. The oblong Kumquat (×¾).

There are two well-defined varieties of this species, the oblong and round fruited; the oblong fruit (Fig. 1213) is about 1¼ inches long by 1 in diameter, and all the fruits of this variety are almost of an exact size, not so much variance being noticed among them as in hens' eggs. On the contrary, the round fruits (Fig. 1214) are produced with great difference in size, varying from ¼ to a full inch in diameter. There is also some difference in flavor and thickness of skin between the varieties, the oblong being more esteemed. For an account, with illustrations of the two types of Kumquat, see A. G. 21:345 (1900). The fruit, when eaten out of hand, is entirely consumed, excepting the few small seeds; almost everyone tasting it seems to relish the combined flavor of skin, pulp and juice. Its chief use, however, is in making marmalade or preserves. The fruit is used whole in heavy syrup, and makes a delicious dainty. It is also candied and used in fine confectionery.

1214. Round Kumquat (×½).

E. N. Reasoner.

KÝDIA (Col. Robert Kyd, founder of the Calcutta Botanic Garden, died 1794). *Malvàceæ.* Three species of oriental trees, one of which is cult. in S. Fla. and S. Calif. *K. calycína* has white or pink fls. somewhat like those of Hibiscus, and borne in long panicles. This genus belongs to a subtribe characterized by having 2 or more ovules. Kydia has 4–6 bractlets; Abutilon none; Sphæralcea 3. Kydia has fls. polygamous; petals 5; staminal tube divided about the middle into 5 divisions, each bearing 3 anthers, which are imperfect in the pistillate fls.

calycína, Roxb. Tree, attaining 25 ft.: lvs. 4–5 in. long, 3 in. wide, rounded, cordate, palmately 7-nerved, more or less lobed, midlobe longest, close felted beneath; petiole 1–2 in. long: inflorescence much-branched, many-fld.

L

LABELING. Figs. 1215–1218. The characters demanded in a good plant label are legibility, convenience, durability and a reasonable cheapness. The purposes for which labels are needed by the horticulturist may be grouped as follows: (1) For pots, boxes, frames and benches; (2) for stock in storage or transit; (3) for rows, plots or beds in garden, nursery, orchard, etc.; (4) for individual trees, shrubs and plants.

Of the materials that may be used for labels, wood holds the first place, and the soft, easily worked nature of white pine makes this the favorite, though other more durable woods, such as cedar, cypress, spruce and mulberry, are used to some extent. Machine-made, ready painted wooden labels of convenient shapes and sizes, from 4 to 12 inches in length, (see 1, Fig. 1215) are carried in all stocks of gardeners' supplies, and are in common use in all work with plants in pots, boxes, benches, etc., and to some extent in out-of-door gardening; but these should not be trusted when the label is expected to endure for a considerable time. In the storage of grafts and cuttings in pits or cellars, two of these labels should be written and slipped together under the tie, the outer one for immediate reference and the under and protected one for security when the other becomes defaced.

Notched or perforated labels (2, 3, Fig. 1215), with or without wires, are also prepared for nurserymen's use, those strung with soft copper wire being the best. These are used in the shipping of nearly all trees and shrubs, and here great annoyance would be saved if all names were written distinctly and with a heavy impression. If such labels are used on stock after planting, the grower should use great care that stems and branches are not choked by the wire. The printing of any desired names may be procured on order, effecting a great saving of time and a gain in distinctness.

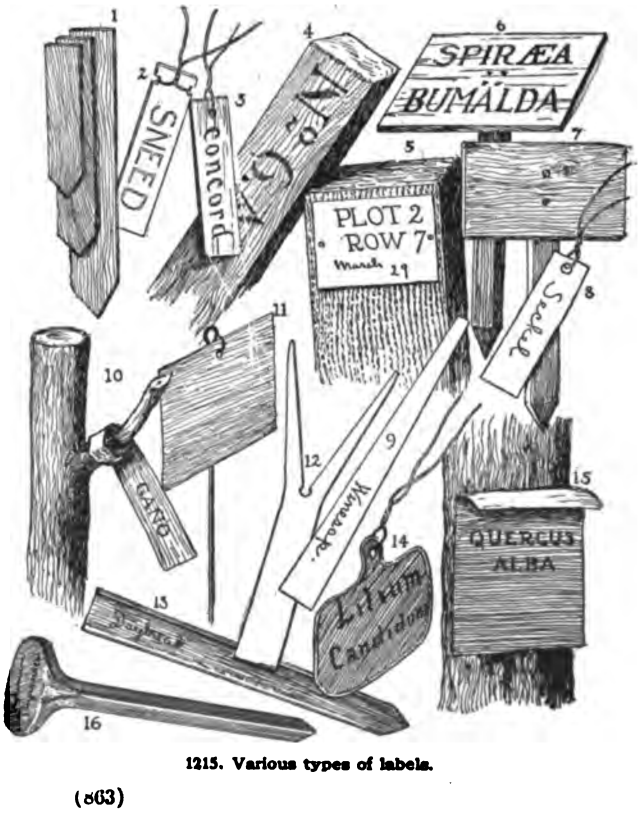
For marking rows, plots, etc., stakes should be used large enough to readily attract attention and not be broken over or moved in cultivation. A very serviceable stake for nurseries, trial grounds and gardens is made by cutting 2 inch pine or cypress plank 2½ inches wide and 2 feet long, pointing and giving two good coats of paint. Inscriptions may be stenciled on these as suggested in 4, Fig. 1215, written with a heavy pencil, or better, when names, dates and list or plot numbers are wanted, written on a square of sheet zinc and fastened to the face of the stake with small nails. (No. 5.) An annual coat of paint obliterates old lettering and preserves the wood.

A common wooden label for borders, groups or specimen plants is shown by No. 6 and a variation by No. 7. The stakes should be of some durable wood, and the whole well painted. A paint of pure lampblack and oil is the most indestructible that we have, and letters of this will stand out like type after the lead paint and the very wood surface have weathered away from them. An effective contrast is obtained by painting the face of the label black and doing the lettering in white.

For more permanent labels in a variety of forms, sheet zinc has proved superior to all other materials. It may be stamped with steel letter dies or written upon with a common lead pencil, but more commonly a chemical ink is used. The common formula for this in horticultural books is substantially that prepared by the French chemist, Brainnot, in 1837, and is as follows: Take two parts by weight of verdigris (acetate of copper), two of sal ammoniac (ammonium chloride), one part of lampblack and thirty parts of soft water. The chemicals should be incorporated with a little of the water, and the balance added. Keep in a glass bottle tightly corked and shake frequently while using, as the lampblack tends to separate. The zinc, cut in the desired forms, should be prepared by scouring slightly with emery dust or fine sand paper. The ink may be applied with a quill or coarse steel pen, but a fresh one will be needed with each batch of labels. Inks of an aqueous solution of chloride of copper or of chloride of mercury are also recommended for writing on zinc, which should first be cleaned with a weak solution of muriatic acid. Bichloride of platinum is one of the blackest inks for zinc. A slightly oxidized zinc surface may be written upon with a soft lead pencil, and while the inscription will not be very distinct at first will grow more so with age, and will endure for years.

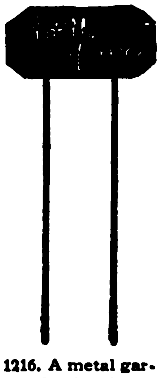
A wired zinc label, as shown in 8, Fig. 1215, if exposed to the wind will sometimes cut out the eye completely, unless care is taken to twist the wire up tightly. Strips of zinc five-eighths of an inch wide and 7 inches long (9, Fig. 1215), coiled loosely around a branch, as in No. 10, are the most serviceable form of tree label, but even these should be noticed every year, that they do not become fastened into the fork of a rapidly-growing tree.

For borders or beds of herbaceous perennials, bulbs, and the like, the label shown in No. 11 is excellent and inexpensive. A piece of galvanized wire Nos. 6–8 in size, is cut 1½ to 2 feet long, bent to shape and the written zinc tablet closed in. For a more conspicuous label, the zinc may be given a coat of white lead, then one of black enamel paint, and the letters be traced in white. In some European botanical gardens a zinc tablet stamped with sunken letters brought into relief by paint are used for similar purposes. A zinc label, with two wire legs to



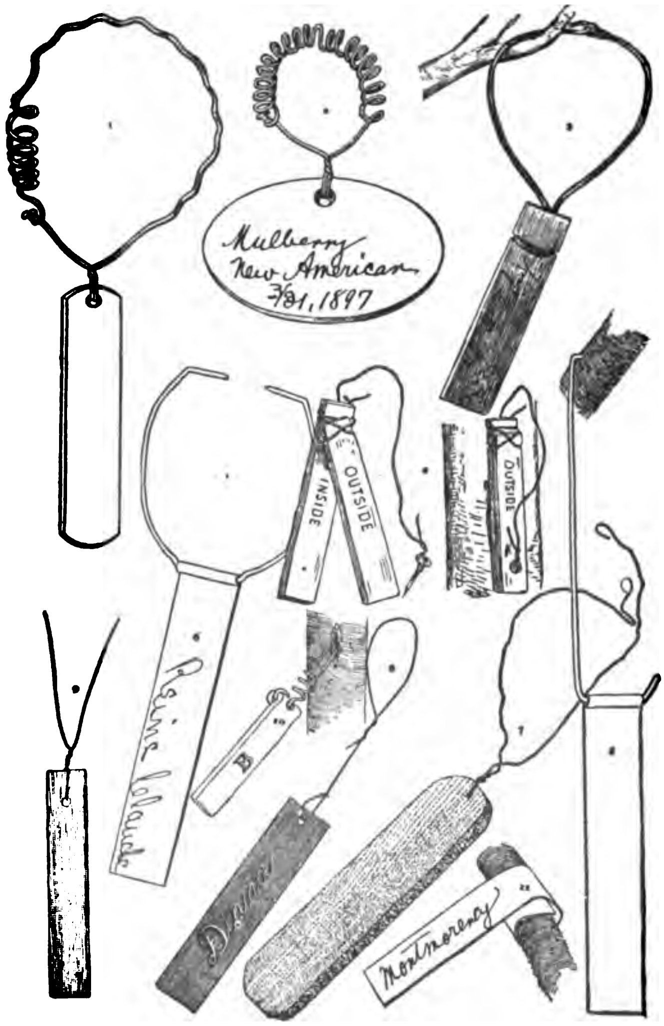
1215. Various types of labels.

prevent it from turning around, is shown in Fig 1216. It can be made for about $2 per hundred, with the face 3¼ x 1⅛ inchs.



1216. A metal garden label.

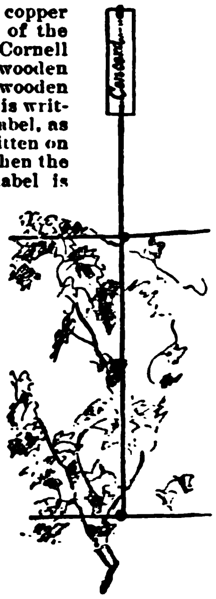
There are many designs of expensive cast or enameled metal or porcelain labels, that have found little use in this country. A label of stamped zinc of English manufacture (shown in 16, Fig. 1215) is one of the best garden labels. For Labeling specimen tree trunks, a sheet of zinc or copper with a little water-ledge bent at the top, painted, enameled black and lettered in white, is about the best thing we have. It should be secured with copper tacks, and given occasional attention. (See No. 15.) The white bronze tree tablets with letters cast in relief have so far failed to secure general introduction. A series of thin sheet-copper labels, to be written on with a stylus against a soft, yielding surface, as a piece of leather, are shown in Nos. 12, 13, 14. These have proved too frail for exposed out-of-door use, but are very good for conservatory plants, orchards, etc., though the inscription needs rather close examination. In making copper labels, the temper should be taken out and the metal folded on the edges. A neat label for conservatory use is made of white sheet-celluloid with a mat surface, as pencil marks show very plainly on it.



1217. Tree labels of many patterns.

Bailey describes (in "Principles of Fruit-growing") the tree labels shown in Fig. 1217. "1, 2, German labels, made of glazed earthenware, with the name colored blue and sunken. Strong copper wire, coiled, to allow of the growth of the limb, holds the label to the tree. 3, Cornell label, made of wood. 4, double wooden label, consisting of two common wooden labels fastened together. The name is written on the outside of the double label, as in any other label, but it is also written on the inside to insure permanence. When the outside writing is worn off, the label is opened and the inside is still bright. The label is fastened to the tree by a tack or small nail, as shown in the cut at the right. The label is seen opened in the cut at the left. 5, 6, zinc labels, used at the New York State Experiment Station, Geneva. The wire is driven into the tree, and the name is written or printed on the zinc with black paint. 7, common hand-made wooden tag, taken from an old tree in the test orchard of the late Charles Downing, Newburgh, N. Y. 8, thin copper label, with the name indented into the metal by the use of a hard-pointed instrument. Some metal labels are liable to tear out at the hole when exposed to winds. 9, common painted pine label used by nurserymen, and costing (without the copper wire) about 35 cents per thousand for the common size, which is 3½ inches long. 10, Lodeman's label, used somewhat at Cornell, consisting of a tag of sheet lead securely fastened to a coiled brass wire. The wire is secured to the body of the tree by a staple or screw-eye, and it is expected that the wire will become imbedded in the trunk as the tree grows. No. 11, common zinc label or tally." A good vineyard label is shown in Fig. 1218, described by Bailey as follows: "The figure is Paddock's vineyard label (designed by W. Paddock, State Experiment Station, Geneva, N.Y.). The label is a strip of heavy zinc secured to a stiff galvanized wire. This wire or shank is provided with a hook at the lower end and a half-hitch near its middle, so that it can be securely adjusted to the wires of the trellis, holding the label well above the foliage."

S. C. Mason.



1218. Paddock's vineyard label.

LABLAB BEAN. See *Dolichos.*

LABRADOR TEA. See *Ledum.*

LABÚRNUM (ancient Latin name). *Leguminòsæ.* Including *Podocytisus.* Golden Chain. Ornamental shrubs or small trees, with alternate trifolioliate petioled lvs., and yellow papilionaceous, showy fls. in many-fld., usually pendulous racemes. *L. alpinum* is hardiest, *L. vulgaris* is almost hardy in Mass., while *L. Caramanicum* is tender. They are adapted for planting on rocky slopes or in borders of shrubberies, when they should be allowed enough space to show to the best advantage their graceful, drooping racemes of golden fls., which contrast with the dark green foliage. They are hardly ever attacked by insects or fungi. The lvs. fall late in autumn without changing color. They thrive in any kind of well-drained soil, including limestone, and grow as well in partly shaded positions as in sunny ones. Prop. by seeds, sown usually in spring, and also by layers; the vars. are mostly grafted or budded on seedlings of one of the species. Three species in S. Europe and W. Asia, often included under Cytisus. Lvs. exstipulate; fls. slender-pedicelled, in terminal simple racemes, mostly pendulous; calyx 2-lipped, with obtuse, short lips; corolla papilionaceous, with the petals all distinct: ovary stalked: fr. a linear pod with several seeds, compressed, tardily dehiscent; seed without appendage at the base. All parts of the plants are poisonous, especially the young fruits. The hard, tough and close-grained wood is susceptible of a very fine polish, and is manufactured into various small articles. Consult *Cytisus*, *Genista* and *Petteria* for names not found in this genus.

vulgàre, Griseb. (*L. anagyroides*, Medic. *Cýtisus Labúrnum*, Linn.). GOLDEN CHAIN. BEAN TREE. Fig. 1219. Large shrub or small tree, to 20 ft., with erect or spreading branches: branchlets appressed-pubescent, grayish green: lvs. long-petioled; lfts. elliptic or elliptic-ovate, usually obtuse and mucronulate, glaucous-green and appressed-silky pubescent beneath when young, 1–1¾ in. long: racemes silky-pubescent, 4–8 in. long: fls. about ¾ in. long: pod appressed-pubescent, with thick peel, about 2 in. long; seeds black. May, June. S. Europe. Gn. 25, p. 518; 34, p. 30, and 51, p. 302.—There are many garden forms, as var. **aùreum**, Hort., with yellow foliage, F.S. 21:2242–43; var. **bullàtum**, C. Koch (var. *involùtum*, Hort.), with curled lfts.; var. **Carlièri**, C. Koch, with very small and narrow lfts. and long and slender racemes; var. **péndulum**, C. Koch, with pendulous branches, Gn. 25, p. 522; var. **quercifòlium**, C. Koch, with sinuately lobed lfts., Gn. 25, p. 520 and 34, p. 30; var. **sessilifòlium**, C. Koch, with crowded, sessile lvs.

1219. Golden Chain. Laburnum vulgare (×⅓).

alpìnum, Griseb. (*Cýtisus alpìnus*, Mill.). SCOTCH LABURNUM. Shrub or tree, to 30 ft., similar to the former: branchlets glabrous or hirsute when young: lfts. usually elliptic, acute, pale green and glabrous beneath or sparingly hirsute, ciliate, 1–1¾ in. long: racemes long and slender, glabrous or sparingly hirsute: fls. smaller: pod thin, with the upper suture winged, glabrous; seed brown. June. Mts., S. Europe. B.M. 176 (as *Cytisus Laburnum*). Gn. 25, p. 519 and 34, p. 30.—This species flowers about two weeks later than the former, and has much longer and more slender racemes; it also is of more upright and stiffer growth and hardier.

Wátereri, Dipp. (*L. Párksii*, Hort. *C. alpìnus×vulgàris*, Wittst.). Hybrid of garden origin, but found also wild. Lvs. beneath and racemes sparingly pubescent: racemes long and slender: pod with narrow wing, sparingly appressed-pubescent.—As hardy as *L. alpinum* and sometimes considered to be a variety of that species.

Ádami, Kirchn. (*C. Adami*, Poit. *C. Labúrnum purpuráscens*, Loud. *L. vulgàre×Cytisus purpùreus*). Probably graft-hybrid, originated at Vitry, near Paris, about 1826. Habit and foliage usually almost like *L. vulgare*, but fls. dull purplish, rarely yellow; sometimes bearing a few branches with the fls. and lvs. of *Cytisus purpurens*. A very interesting form, but of less ornamental value. B.R. 23:1965. B.H. 21:16–18.—Much discussed by Darwin and others as an example of graft-hybridism.

L. Caramánicum, Benth. & Hook. (Podocytisus Caramanicus, Boiss.). Erect shrub, to 4 ft., much resembling in foliage and habit the Cytisus sessilifolius, with long and slender terminal upright racemes. July–Sept. Asia Minor. R.H. 1861, p. 410.—*L. fràgrans*, Griseb., *L. ramentàceum*, C. Koch, and *A. Wéldeni*, Lavall.=Petteria ramentacea.

ALFRED REHDER.

LABYRINTHS or mazes are still kept up in some Old World gardens as relics of the past. They were popular in the sixteenth and seventeenth centuries. Fig. 1220 is the plan of an English Labyrinth of two centuries ago. It would be vandalism to destroy so fine an example of a style of gardening no longer fashionable, but folly to copy it in a modern garden. Mazes are made of clipped evergreens of various kinds.

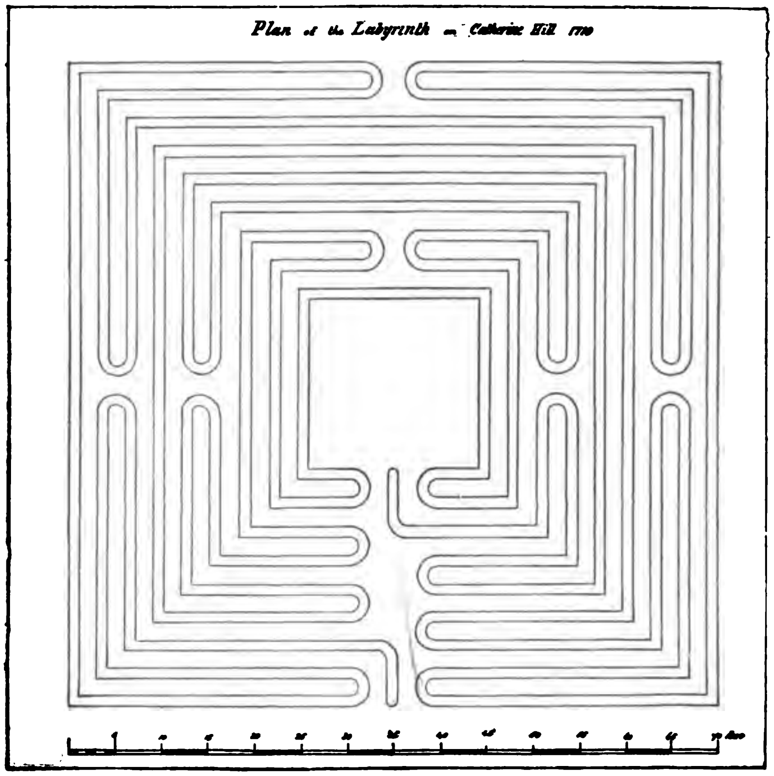
LACÆ̀NA (one of the names of Helen, which Lindley states may be applied to this plant on account of its beauty, a compliment which the plant does not at all merit; but he adds it may also be derived from *Lakis*, a cleft, alluding to the divisions of the lip, but this derivation is impossible). *Orchidàceæ*. A little-known genus containing only 2 species inhabiting Central Amer. Pseudobulbs rather long, ovoid, smooth at first: lvs. large, elliptic-pointed and contracted into a petiole, plicate venose: raceme pendent from the base of the pseudobulbs, loose, bearing up to 10 medium-sized fls.: sepals and petals nearly equal, elliptical, half-spreading; labellum equaling the petals, articulated to the base of the column, clawed, with the lateral lobes incurved, terminal larger, spreading and narrowed at the base to a broad claw: column rather long, winged, hooded at the top; pollinia 2 on a simple stipe.

The plants should be grown in baskets or on blocks of wood like Stanhopeas: if potted the racemes are likely to bury themselves in the soil. At the end of October water should be almost entirely withheld for a few weeks. The flower-stalks appear in spring.

bicolor, Lindl. Racemes drooping, about 18 in. long, bearing 9 or 10 fls. The fls. are greenish yellow, covered externally with short hairs; petals with 3 purple streaks; labellum hairy, spotted with purple. Discovered about 1843 in Guatemala, at an elevation of 7,000 ft. B.R. 30:50.—Var. **glabràta**, Lem. Fls. everywhere nearly glabrous, creamy white. Not in the American trade. I.H. 1:33.

spectábilis, Reichb. f. Fls. about 1 in. in diam., whitish, suffused with pink and speckled with purple; sepals concave orbicular; petals smaller connivent. B.M. 6516.—Far more handsome than the former, but not advertised in America.

HEINRICH HASSELBRING.



1220. The maze on St. Catherine's Hill, Winchester, England. From a plan made in 1710. (See Labyrinths, p. 865.)

LACHENÀLIA (Werner de Lachenal, 1736–1800, professor of botany at Basel). *Liliàceæ*. CAPE COWSLIPS. Lachenalias (Fig. 1221) are Cape bulbs that are easily flowered in a cool greenhouse in early spring or even in winter. They have a remarkable range of color, and with good management may be kept in an attractive condition for two months or more. There are species with bell-shaped flowers, and some in which the flowers are all more or less erect, but the favorite types are the long, cylindrical, pendulous flowers with the brilliant red and yellow colors. Of the 42 species, about 9 are cult., the most popular being *L. tricolor*, particularly its var. *Nelsoni* and some of the recent forms with personal names. *L. pendula* is perhaps second in popularity, the rest being known chiefly to bulb fanciers. Lachenalias are very distinct in coloring and general appearance. They usually have 2 leaves (sometimes 5 in cult.), rarely 1, and the bulbs are globose, tunicated, and about ½–1 in. thick. An exceptionally strong bulb, under the most favorable conditions sends up 3 or 4 erect flower-stalks 9 in. high, with as many as 40 flowers, each 1–1½ in. long. Under careless treatment the leaves and flower-stalks are weaker, and bear perhaps 6–12 flowers. Lachenalias are fine subjects for hanging baskets.

This genus is also interesting when studying the evolution of the perianth. In our common lilies the 6 segments are all the same size and all colored like petals. Lachenalia has only 1 species in which the segments are practically equal. The others vary wonderfully, but usually the inner segments are longer, and sometimes the outer segments are small and more or less greenish, thereby suggesting the division of perianth into calyx and corolla. The genus is monographed in English by Baker in the sixth volume of Flora Capensis, which contains all the Cape bulbs and should be in the hands of every bulb specialist.

It should encourage the amateur to know that the recent improvement of Lachenalias is largely due to two English amateurs. *L. Nelsoni*, the first and one of the best hybrids, was rasied, not in a greenhouse, but in a home window, by the Rev. John Nelson. Four fine hybrids, raised by T. H. Marsh, are shown in Gn. 46:981, where their parentage is given. *L. Nelsoni* has played an important part in the production of these hybrids, Ruby, Cawston Gem. Little Beauty and Topaz, all of which are in the trade.

W. M.

It is well to make one job of it, planting Freesias and Lachenalias together. Six are planted in a 6-inch pot, in good rich loam. They probably do as well without leaf soil, if the drainage be good. They are stored in a well protected coldframe until late in November, but might be kept longer, as a pinch of frost will not hurt them. After they are brought into the greenhouse, and make good growth, plenty of water may be given, and, occasionally, liquid manure. A night temperature of 50° F. will be found about right, but they scarcely bear forcing until the flowering scapes show. If forced before the buds show, the flowers are often malformed. With good management they remain in bloom from six to eight weeks.

After blooming, the plants should be set on a shelf in a light position and watered as carefully as before the blooming season, less water being given as signs of maturity appear; viz., discolored leaves and withered flower-stems. When thoroughly ripened, they are stored in the pots they have grown in and kept quite dry until the month of August. They must be repotted then. If by chance drip should strike the soil, the plants may be found starting into growth. The bulbs multiply rapidly, more than doubling in a season. Fully one-third of the extra bulbs will be serviceable, and still more would make bloom of less decorative value. There are many more—bulblets—which can be sown on the borders of carnation or violet benches, a large number making good-sized bulbs in one season. Seeds of Lachenalias germinate readily in a few weeks, and with good treatment many seedlings will bloom before going to rest. In the opinion of the writer, *L. Nelsoni* is still the most satisfactory kind to grow.

T. D. HATFIELD.

INDEX.

aurea, 6.
Aureliana, 4.
Cammi, 6.
glaucina, 3.
luteola, 6.
Nelsoni, 6.
orchioides, 2.
pallida, 8.
pendula, 4.
pustulata, 7.
quadricolor, 6.
reflexa, 1.
rubida, 5.
tricolor, 6.
unifolia, 9.
violacea, 7.

A. *Base of perianth oblique* .... 1. **reflexa**
AA. *Base of perianth equally rounded.*
  B. *Form of perianth more or less cylindrical.*
    C. *Fls. all erect or at most spreading.*
      D. *Length of perianth 4 lines*.... 2. **orchioides**
      DD. *Length of perianth 6–9 lines*.. 3. **glaucina**
    CC. *Fls. drooping or pendulous, at least the lower ones.*
      D. *Inner segments scarcely longer than the outer* .... 4. **pendula**

DD. *Inner segments 2–3 lines longer than the outer*....... 5. **rubida**
DDD. *Inner segments 3–4 lines longer than the outer*....... 6. **tricolor**
BB. *Form of perianth bell-shaped.*
C. *Lvs. pustulate*, i. e., *covered with blister-like elevations.*
D. *Inflorescence spicate*......... 7. **pustulata**
DD. *Inflorescence racemose*....... 8. **pallida**
CC. *Lvs. not pustulate*.............. 9. **unifolia**

1. **refléxa,** Thunb. Lvs. clasping the base of the stem for 1–2 in.: spike usually few-fld.: fls. all erect or spreading, yellowish.

2. **orchioides,** Ait. Lvs. strap-shaped, often spotted, 1 in. wide, clasping the base of the stem: fls. white, yellow, red or blue. B. M. 854 and 1269. L. B. C. 11:1076 (as *L. mutabilis*). "The most striking color forms," says Baker, "are **atroviolàcea,** hyacinth blue; **virenti-flàva,** greenish yellow, and **mutábilis,** inner segments dull yellow, tipped red-brown."

3. **glaucina,** Jacq. Lvs. as in No. 2: fls. long, white, red, yellow or tinged blue. B.M. 3552 (wonderfully varied in color). B.R. 16:1350 and 23:1945.

4. **péndula,** Ait. Bulb globose, about 1 in. thick: peduncle 6–12 in. long, more robust than in Nos. 5 and 6: raceme few- or many-fld., 2–6 in. long, all except the upper fls. more or less nodding: outer segments yellow, passing upwards into red, not spotted; inner bright red-purple at the tip. B.M. 590. Gn. 18:241; 23, p. 142; 33, p. 249, and 45, p.355. F. 1871:265. V. 8:172. Var. **Aureliàna** has outer segments red, barely tipped yellow; inner ones tipped green. R.H. 1890:396. G.C. III. 23:195.

5. **rùbida,** Jacq. Bulb about ½ in. thick: peduncle 6–9 in. long: lvs. spotted: raceme 6–20-fld.: outer segments bright red, tipped green; inner ones yellow below the tip.

6. **tricolor,** Thunb. Lvs. often spotted: lower fls. nodding; outer segments yellow, tipped green; inner purplish red at the tip. L.B.C. 8:767. B.M. 82. F. 1871: 265. Gn. 18:241 and 47, p. 163. Var. **quadricolor** (*L. quadricolor*, Jacq.), perianth with a red base and greenish yellow middle; outer segments tipped green; inner ones tipped red-purple. L.B.C. 8:746. Var. **lutèola** (*L. lutèola*, Jacq.), perianth lemon-yellow, tinged green towards the tip. L.B.C. 8:734. F.S. 18:1873. B.M. 1704 and 1020. Var. **lutèola maculàta** (*L. luteola maculata*, Hort.), differs from the preceding in having spotted foliage. Var. **Nélsoni** (*L. Nélsoni*, Hort.). Fig. 1221. Perianth bright yellow, both series of segments faintly tinged green. Gn. 49, p. 470. Gng. 5:262. J. H. III. 30:231. Var. **àurea,** Hook. (*L. àurea*, Lindl.), perianth bright orange-yellow. F. 1871:265. B.M. 5992.—"The varieties are connected by intermediate stages. Several hybrids between *L. pendula* and the varieties of *L. tricolor* are in cult., the finest of which is *L. Cammi*, Hort., which combines the bright yellow fls. of *L. aurea*, with the habit of *L. pendula*."

1221. Lachenalia Nelsoni (× ¼).

7. **pustulàta,** Jacq. Lvs. lanceolate: fls. white or faintly tinged red. B.M. 817. Perhaps synonymous with No. 8. Var. **violàcea** is cult.

8. **pállida,** Ait. Lvs. strap-shaped: fls. white; outer segments tipped green. B.M. 1372.

9. **unifòlia,** Jacq. Differs from all described above in having only one leaf, which is linear to awl-shaped, and has a band of brown at the base: fls. white, or more or less tinged with red or blue. B.M. 766.

L. viridis, Thunb., is Dipcadi filamentosum, which is distinguished from the species of Lachenalia by having 3–6 lvs., which are linear: raceme very lax: fls. bright green. Cape. In Dipcadi the outer segments usually have a tail, which is lacking in Lachenalia; and the seeds of Dipcadi are strongly compressed, while in Lachenalia they are obovoid or globose. D. viride is distinguished from all other species in its genus by the outer segments being falcate, 9–12 lines long, distinctly longer than the inner ones, which are connivent: lvs. linear, not crisped, 3–6 lines broad.

W. M.

LACTÙCA (from the old Latin name *lac;* referring to the milky juice). *Compósitæ.* LETTUCE. A well-known genus of hardy annual or perennial herbs, mostly native of the northern hemisphere. More than 200 specific names have been given to the genus, probably half of which are synonyms with but only 8 or 9 known in cult., and these are doubtless forms of but 2 or 3 species. Plants 2–4 or more feet high, with alternate, variously shaped lvs. and small-panicled heads of yellow, white or blue fls. Only 1 species is to be found in the American trade, though wild plants of other species are often gathered for medicinal purposes or used as a salad. All of the species possess narcotic and sedative properties, the sedative known as lactucarium or lettuce-opium, being obtained principally from the European species, *L. virosa*. Lettuce has been known and used as a salad from a very remote period. It is said to have served at the tables of Persian kings 400 B.C. See *Lettuce*.

sativa, Linn. LETTUCE. An annual plant, not known in the wild state but generally supposed to have originated from *L. Scariola*, Linn., in Asia. There are many garden varieties assuming an endless variety of forms but which may be divided into 4 quite distinct types.

Var **capitàta,** Hort. (*L. capitàta*, DC.). COMMON CABBAGE LETTUCE. Lvs. entire or sparingly dentate, broad, rounded, yellowish or brownish green, more or less wrinkled and in some garden varieties much curled, spreading, 6–14 in., usually quite compact.

Var. **intybàcea,** Hort. (*L. intybàcea*, Jacq. *L. quercìna*, Linn.). CUT-LEAVED LETTUCE. Lvs. 6–10 in. long, deeply and irregularly cut on the edges, loosely spreading.

Var. **Romàna,** Hort. COS LETTUCE. One to 2 ft. high: lvs. entire or sparingly dentate, much longer than broad, quite erect, forming a cylindrical or conical-shaped plant.

Var. **angustàna,** Hort. (*L. angustàna*, Hort.). Lvs. 1–2 in. wide, 6–12 in. long, entire, slightly spreading in habit.

L. Canadénsis, Linn. Biennial, 4–9 ft. high: lvs. entire or nearly so. Wild plants often gathered for salad.—*L. perénnis*, Linn. Root perennial, 2–3 ft. high: lvs. 8–10 in. long, deeply cut: fls large, purple. Native of Eu.—*L. Scariola*, Linn. PRICKLY LETTUCE. Annual or biennial, sometimes 6 ft. high: lvs. 1–2 in. wide, 4–6 in. long: fls. yellow, inconspicuous. Int. from Old World, and now a widely distributed weed.

H. C. IRISH.

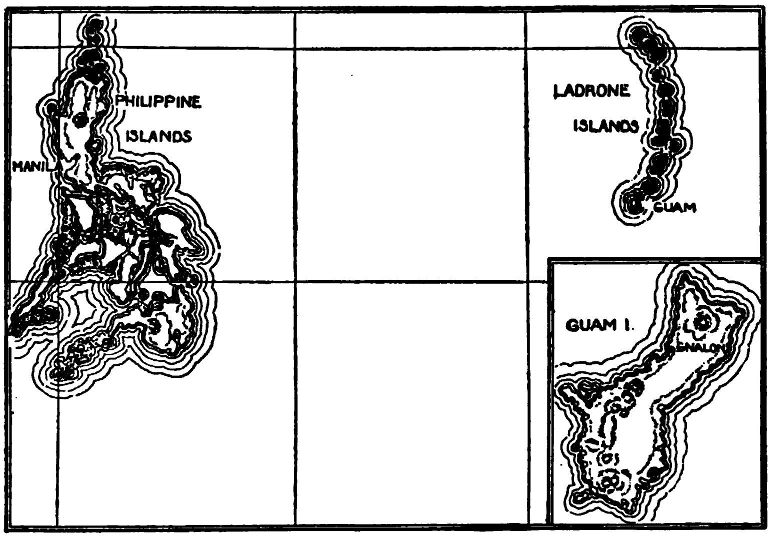
LADRONES. The Ladrone or Mariana Islands (Fig. 1222) lie about 1,200 miles east of the Philippines. The seventeen islands contain about 400 square miles. Guam is the southernmost of the islands, and is about as large as all the rest together. It is 600 miles from the northernmost of the group. The Ladrones lie in an almost straight line north and south. They were captured from Spain in July, 1898, and Guam was retained by the United States chiefly as a coaling station.

The Ladrones were discovered in 1521 by Magellan in the first voyage round the world. They were the first islands in the Pacific to come into continuous contact with European civilization. The aboriginal race, the Chamorros, is extinct, and was replaced chiefly by Tagals from the Philippines. These have deteriorated.

The chief settlement is Agana, on the island of Guam, which contains a majority of the population of the whole group. The Spaniards had but one mail a year between the Ladrones and the Philippines.

The Ladrones are well wooded, but the original flora has almost vanished. None of the Pacific islands possesses any metal, or any native mammal, save a kind of bat.

The Ladrones are said to have a more agreeable climate than is common within the tropics. There is moisture at all times, but a so-called "dry season" lasts from June to Sept., during which time the northeast trade winds prevail. The rainfall is in most places abundant. The highest part of Guam is 1,500 feet above the sea.



1222. Ladrones.

The Ladrones have exported no fruit to speak of. Cocoanuts and bananas are perhaps the chief fruits. Guava figs and breadfruit grow well. Other products are rice, sugar, indigo, arrow-root, cotton, tobacco, and even wheat.

One of the best recent accounts of the Ladrone Islands is in Appleton's Annual Cyclopedia for 1898. For maps of the Ladrones, see Century Atlas, and Overland Monthly 33:92. For references to recent literature, see the Cumulative Index of Periodical Literature. There is a book on the history of the Ladrones written in Spanish. It is an octavo of 210 pages published at Granada in 1886, and entitled Historia de las islas Marianas. The author is Luis de Ibañez y Garcia.

LADY'S EARDROPS. Short-flowered Fuchsias. **L. Garters.** *Phalaris arundinacea*, var. *picta*. **L. Mantle.** *Alchemilla vulgaris*. **L. Slipper.** *Cypripediums*. **L. Smock** or Meadow Cress. *Cardamine pratensis*. **L. Tresses.** *Spiranthes*.

LÆLIA (meaning uncertain). *Orchidàceæ*. A useful and attractive genus of orchids, mostly with large, showy fls. borne singly or in 2- to many-fld. racemes, which arise from the top of 1-2-lvd. pseudobulbs. The plants greatly resemble Cattleyas, and differ only by the presence of 8 perfect pollen masses instead of 4, as in Cattleya. Lvs. oblong, coriaceous or fleshy, not plicate: pseudobulbs terminating the annual growth, ovate, clavate, fusiform or stem-like, long or short, consisting of 1 to several thickened internodes, or of slender and quill-like form with merely a small bulbous swelling at base, sheathed with scales and bearing 1 or 2 lvs. at the summit: sepals subequal, free, spreading; petals wider and sometimes longer, spreading; all usually plane: labellum free from the base of the column, more or less distinctly 3-lobed, the lateral lobes short, erect, folding over the column; middle lobe long, expanded, lanceolate-ovate, etc.: column concave in front, and thus narrowly 2-winged on the edges: pollinia 8, 4 in each locule: scape terminal, long or short, bracted.

The genus contains about 30 species, dispersed in the maritime provinces of Mexico and Guatemala and in S. Brazil. No species is common to the two widely separated regions. A single species, *L. monophylla*, inhabits the mountains of Jamaica. In their native homes the plants are often found clinging to bare rocks and trees, where they are exposed to the full force of the tropical sun, and, in the wet season, to daily drenching rains. Some of the species grow at great altitudes. Thus, *L. autumnalis*, var. *furfuracea*, is always found in alpine regions at elevations of 7,500-8,500 ft. For a list of cultivated kinds, see R. A. Rolfe. G.C. III. 7:107, 256, 333, 355; and 8:241, 652.

Lælia may be conveniently divided into groups, as follows:

Group I (species 1-10).—Pseudobulbs rounded, pyriform or ovate. The plants of this section are medium-sized, with the pseudobulbs terminating each year's growth sessile at intervals on the rhizome, and sheathed at least at first with bract leaves. The scape, except in *L. grandiflora*, is long and slender, erect, nodding or sub-horizontal, and bears at its end 1 or 2 fls. (*L. anceps*), or a raceme of 2-7 fls. (*L. albida*). *L. grandiflora*, placed here on account of its thickened pseudobulbs, bears greater resemblance to the members of the next group.

Group II (species 11-13).—Pseudobulbs short-cylindrical, stem-like, or swollen jointed, i. e., consisting of several internodes and sheathed with bracts. These plants are of dwarf habit, bearing 1-2 very large fls. on short scapes, so that the top of the flower scarcely exceeds the lvs., which are oblong, about 6 in. long, and leathery.

Group III (species 14-23).—Pseudobulbs long-oblong, fusiform or clavate, tapering below to a sheathed and jointed stalk. This group contains the largest and most showy Lælias. The pseudobulbous stems are tall and tufted, a foot or more in length, forming robust, compact, almost bushy plants. The flowering stems of *L. superbiens* are said to attain a height of 12 ft. The racemes bear 3-7 large, handsome flowers.

Group IV (species 24-26). Pseudobulbs slender, reed-like and tufted, clothed with scales and often somewhat swollen at base. This group includes a few species which are very distinct on account of their bright scarlet or orange-colored fls. and slender, reed-like pseudobulbs. *L. monophylla* is perhaps the smallest of all Lælias, being scarcely over 6 in. high, with pseudobulbs about as thick as a crow-quill. One variety of *L. cinnabarina* has purple fls.

INDEX.

acuminata, 10.
alba, 2, 4, 9, 11, 23.
albida, 3.
Amesiana, 9.
anceps. 9.
Ashworthiana, 9, 22.
atropurpurea, 22.
atrorubens, 4.
Arnoldiana, 5.
autumnalis, 4.
Barkeriana, 9.
bella, 3.
Boothiana, 20.
caulescens, 1.
Cauwelærtiæ, 21.
cinnabarina, 26.
crispa, 21.
crispilabia, 26.
Crawshayana, 7.
Dawsoni, 9.
Dayana, 12.
delicata, 9.
Digbyana, 14.
Eyermanniana, 6.
flava, 1.
Förstermannii, 5.
Fournieri, 4.
furfuracea, 4.
glauca, 15.
Gouldiana, 8.
grandiflora, 2, 9.
grandis, 18.
harpophylla, 25.
Hilliana, 9.
holochila, 9.
Jongheana, 11.
Lawrenciana, 26.
Leeana, 9, 13.
Lindleyana = Cattleya Lindleyana.
lobata, 20.
majalis, 2.
majus, 2, 3.
Mandaiana, 22.
marginata, 12.
monophylla, 24.
morada, 9.
Nelisii, 22.
peduncularis, 10.
Pinelii, 12.
Percivaliana, 9.
Perrinii, 23.
præstans, 12.
prætexta, 22.
pumila, 12.
purpurata, 22.
Rivieri, 20.
rosea, 3, 9.
rubescens, 10.
Russelliana, 22.
Sanderiana, 9.
Scottiana, 9.
Schrœderi, 22.
Schroderiana, 9.
Stella, 9.
superbiens. 19.
sulphurea, 3.
tenebrosa, 18.
venusta, 4.
Veitchiana, 9.
virens, 16.
Waddoniensis, 9
Williamsi, 9.
xanthina, 17.

The following names must be sought under Læliocattleya: *L. amanda, Dominiana, Dormaniana, elegans, euspatha, Exoniensis, Nyleptha, prasiata, Schilleriana, Turneri.*

GROUP I.

A. *Pseudobulbs not compressed or edged.*
B. *Fls. bright yellow* .... 1. **flava**
BB. *Fls. rose, purple or white.*
C. *Scape scarcely equaling the lvs.: dwarf plants, with very large fls* .... 2. **grandiflora**
CC. *Scape slender, much exceeding the lvs.*
D. *Fls. small, white or pale yellow* .... 3. **albida**
DD. *Fls. large, rose-purple; rarely white.*
E. *Lip 2-keeled* .... 4. **autumnalis**
5. **Arnoldiana**
EE. *Lip 3-keeled.*
F. *Lvs. oblong* .... 6. **Eyermanniana**
FF. *Lvs. lance-linear or oblong-linear*...... 7. **Crawshayana**
8. **Gouldiana**
AA. *Pseudobulbs compressed and edged.*
B. *Lip with a broad, elevated line down the center: ovary viscose.* 9. **anceps**
BB. *Lip with 3 keels: ovary not viscose* ....10. **rubescens**

1. **flàva,** Lindl. (*L. cauléscens*, Lindl.). Lvs. 3–5 in. long, oblong-lanceolate, acute, very thick and stiff: scape 1 ft., erect, bearing 4–8 bright yellow fls. 2–2½ in. in diameter: sepals and petals spreading, oblong-lanceolate, obtuse or subacute; labellum not longer than the petals; middle lobe recurved, crisped and undulate, having 4 elevated ridges running down the center; lateral lobes obtuse. Autumn. Braz. B.R. 28:62.

2. **grandiflòra,** Lindl. (*L. majàlis*, Lindl.). Lvs. solitary, oblong, coriaceous, 6–7 in. long: fls. solitary, rarely 2, on a short peduncle, scarcely equaling the lvs., 5–8 in. across, showy, rose-lilac; sepals lanceolate, plane; petals oblong, acute, shorter and much broader than the sepals; middle lobe of the labellum large, expanded, emarginate, center white, shading to lilac at the margin, spotted with dark lilac; side lobes small, white inside, streaked with lilac. May, June. Mex. B.M. 5667. B.R. 30:30. P.M. 12:1. G.C. II. 19:623.—A magnificent orchid. Var. **álba,** Reichb. f. White. A.G. 19:109; 20:371. Var. **màjus** is advertised.

3. **álbida,** Batem. Lvs. lance-linear, acute: scape twice as long as the lvs.: fls. 2 in. across, pure, transparent white except a yellow streak down the lip and a few crimson dots at its base, sweet-scented; sepals lanceolate, spreading; petals similar but broader, all very acute; labellum 3-lobed; side lobes small, erect; middle lobe large, round-ovate, reflexed. All autumn and winter. Oaxaca, Mex. B.M. 3957. B.R. 25:54. Gn. 35:695.—The first white-flowered species discovered. Var. **sulphùrea,** Reichb. f. Larger: fls. sulfur-yellow, with a rose-colored border on the middle lobe, and rose spots on the inner surface of the side lobes. Var. **bélla,** Hort., ex-Williams, not Reichb. f. Fls. larger than the type; sepals and petals creamy white, faintly bordered with lilac; lip white, the middle lobe broadly bordered with deep rose and having three yellow ridges down the center. Var. **ròsea,** Hort. Fls. rose-colored. Var. **màjus** is advertised.

4. **autumnàlis,** Lindl. Lvs. oblong-linear, obtuse, coriaceous, 5 in. long: scape 1½–2 ft. long, 5–6-fld., with sheathing scales: fls. showy, fragrant; sepals lanceolate-acuminate; petals oblong-lanceolate, undulate; lateral lobes of the labellum large, erect, rotund-truncate, whitish; middle lobe obovate, obtuse, apiculate, recurved, deep purple; disk with two narrow yellow lamellæ. In color and general appearance much like *L. anceps*, but the segments lack the green ribs. Autumn. Mex. B.M. 3817. B.R. 25:27. I.H. 1:17. P.M. 6:121. G.C. 1872:1009.—Grows on bare rocks and stunted trees in most exposed situations, often at great altitudes. Less valuable than *L. anceps*. Var. **furfuràcea,** Rolfe (*L. furfuràcea*, Lindl.). This seems to be a dwarf alpine form, with the ovary more scurfy and the petals unusually broad. It is always found at great elevations, occurring frequently at 7,500–8,500 ft. Intermediate forms exist. B.M. 3810. B.R. 25:26. Var. **atrórubens,** Backhouse. Pseudobulbs short: fls. large, deep rose or magenta, darker toward the ends of the segments and the labellum; base of the labellum and lateral lobes white. Gn. 17:229. Var. **venùsta,** Hort. Goldring. In habit resembles var. *atrorubens:* stalk 2–3 ft.: fls. large, rosy mauve. Gn. 25:438. Var. **Fourniéri,** Ed. André. Fls. about 6–7 in. across; sepals revolute at the summit, purple-red; petals rhomboid, of the same color, all paler toward the base; labellum white, with the middle lobe colored like the segments. Larger than var. *atrorubens*. R.H. 1896:548. Var. **álba,** Hort. Fls. pure white.

5. **Arnoldiàna,** Manda. Pseudobulbs 4–6 in. long, pyriform, deeply furcate, 2-lvd.: lvs. 5–7 in. long, leathery, lanceolate, thick and dark green: scape 1–4 ft. long, 3–11-fld.: sepals oblong-lanceolate, pointed; petals broader, ovate, all somewhat reflexed, rose-colored; middle lobe of the labellum reflexed, deep rose-purple, paler towards the center; throat with 2 yellow keels, spotted purple; lateral lobes straight, pale rose or white. A species closely related to *L. autumnalis*, from which it differs in having bulbs growing erect and rigid lvs. and in the absence of the fetid odor of *L. autumnalis* (W. A. Manda). Mex. A.F. 5:303.—Var. **Förstermannii,** Hort. Identical with the type, but has pure white fls., with a tinge of delicate pink on the ends of the segments (W. A. Manda).

6. **Eyermanniàna,** Reichb. f. Natural hybrid. Pseudobulbs like those of *L. grandiflora:* lvs. oblong, acute, very leathery, 6 in. long and 2 in. broad: racemes bearing 3–4 fls. up to 4 in. across (as large as those of *L. Gouldiana*, but smaller than *L. autumnalis*), rose-purple (white suffused with bright rosy crimson); sepals lance-oblong, acute; petals broadly oblong or almost rotund, obtuse; side lobes of the labellum oblong; middle lobe rounded, wavy, white bordered with rose and having 3 yellow keels on the disk fading to whitish on the blade, *L. autumnalis* × *L. grandiflora*, Reichb. *L. autumnalis* × *L. albida*, Rolfe. G.C. III. 4:109.

7. **Crawshayàna,** Reichb. f. Natural hybrid. Pseudobulbs and lvs. as in *L. albida:* scape few-(2)-fld., long as in *L. anceps*, but thinner and with shorter, narrower sheaths: sepals and petals narrower than in *L. anceps*, of a fine amethyst color; labellum open near the column; side lobes obtuse angled, antrorse, rich purple at the tips; middle lobe cuneate, abruptly blunt, lower half rich purple; throat yellow, veined with purple, 3-keeled. According to Reichb., a hybrid between *L. anceps(?)* and *autumnalis(?)* or *albida* and *anceps*. J.H. III. 30:67 (as *L. anceps*, var. *Crawshayana*). The plant there figured is probably the species in question, although, according to the figure and the accompanying description, the sepals and petals are wider than those of *L. anceps*.

8. **Gouldiàna,** Reichb. f. Pseudobulbs ovate, 2-lvd.: lvs. oblong-linear: scape slender, 1–2 ft. long, bearing as many as 6 deep rose-purple fls. resembling those

of *L. anceps:* sepals lance-oblong, pointed; petals broader, ovate, acute; middle lobe of the labellum large, deeply colored, throat white and veined; side lobes white. Dec. to Jan. Mex. G.C. III. 7:169.—A useful species, large plants often bearing 5–10 racemes. Perhaps only a var. of *L. autumnalis.*

1223. Lælia anceps. (× ⅓.)

9. **ánceps,** Lindl. Fig. 1223. Pseudobulbs scattered on the rhizome, ovate: lvs. 5–9 in. long, oblong-lanceolate: scape from the top of the pseudobulbs, 1½–2 ft. long, clothed with keeled scales and bearing 1–2 very showy, purplish rose-colored fls.: sepals lanceolate-acuminate; petals ovate-acuminate, all with a greenish line on the back; labellum inside of the lateral lobes yellow, with red marks; middle lobe oblong, acute, deep purple, white on the disk, with a thickened yellow keel terminating in 3 ridges. Mex. B.M. 3804. B.R. 21:1751. G.C. II. 24: 405; III. 15:172. P.M. 4:73.—One of the most beautiful Lælias, possessing many fine varieties. Var. **Barkeriàna,** Lindl. Sepals and petals subequal; middle lobe of the labellum rather narrow, acute. B.R. 23:1947. F.S. 11:1100. Gn. 25:446. Var. **Dáwsoni,** J. Anders. Scape 2–3 ft. long, 2–3-fld.: fls. white; interior of the labellum marked with radiating purple lines, with the usual yellow ridge. Juquila, Mex. Gn. 25:446. G.C. III. 1:424. S.H. 2, p. 175. F.M. 1871:530. Var. **álba,** Reichb. f. Sepals and petals as in var. *Dawsoni:* fls. pure white, with the disk of the lip pale yellow. Dec., Jan. G.C. III. 1:485; III. 15:172. Var. **Hilliàna,** Reichb. f. Sepals and petals white; front lobe ofthe labellum bilobedemarginate. I.H. 33:584. Pale violet, with a yellow disk. Gn. 25:446 (*Hilli*). G.C. III. 1:425 (*Hillii*). Var. **Williamsi,** Hort. Sander. Sepals and petals pure white, of good form, narrower than in var. *Stella;* labellum white, large, with the disk and throat yellow, marked with crimson-purple. G.C. III. 1:349. Gn. 25:446 (as *Williamsiana*). Var. **Leeàna,** Reichb. f. Fls. white, smaller than in *L. anceps;* petals very narrow and very acute; side lobes of the labellum blunt; middle lobe small, triangular, wavy, with a thick, well-developed keel; throat yellowish, veined with reddish-purple. Var. **Schroderiàna,** Reichb. f. Fls. unusually large; sepals, petals and middle lobe of the labellum pure white; side lobes and throat streaked with broad lines of purplish crimson. A strong grower. Gn. 44:928. G.M. 33:813. Var. **Sanderiàna,** Reichb. f. Fls. white; disk of lip crimson. G.C. III. 1:281 and 25:136. Gn. 44:928. G.M. 37:88. Var. **Veitchiàna,** Reichb. f. Sepals and petals white; disk of the labellum yellow, veined with brown; lateral lobes and anterior part of the middle lobe veined with purple. Gn. 25:446 (*Veitchi*). Var. **Stélla,** Reichb. f. Fls. pure white; labellum with yellow throat, marked with light crimson lines. G.C. III. 1:280 and 8:500. Var. **Amesiàna,** O'Brien. Sepals and petals broad, feather-veined with mauve; labellum white; middle lobe crimson-purple. G.C. III. 23:59. Var. **Ashworthiàna,** J. O'Brien. Sepals pure white, lance-oblong; petals broadly ovate, also white; front lobe of the labellum broad, expanded, white, with a few blue dots and yellow keels on the throat; side lobes with lines of slaty blue. G.C. III. 15:103. J.H. III. 28:125. Var. **Waddoniénsis.** Fls. pure white; side lobes of the lip marked with purple lines, disk yellowish. G.C. III. 23:125. G.M. 41:115. Var. **Percivaliàna,** Reichb. f. Fls. small, but freely produced; sepals and petals white, tinged with bluish pink; lateral lobes of the labellum deep purple at the tips and spotted; throat yellow, with purplish crimson lines; middle lobe creamy yellow at the base; apex purplish. Gn. 25:446. Var. **delicàta,** Hort. ex Williams. Labellum white, suffused with mauve; throat orange-yellow; sepals and petals rose, mauve or lilac. Var. **ròsea,** Reichb. f. A variety having bright rose-colored fls., with the margins of the labellum darker rose. Gn. 25:446. Var. **grandiflòra,** Williams. A robust form resembling the type. G.C. III. 3:105. Var. **holochila,** Rolfe. Sepals and petals nearly alike, pale lilac; lip petaloid, elliptical-lanceolate, light purple, yellow and white at the base. G.F. 4:173. Var. **Scottiàna,** Warn. and Will. Sepals and petals mauve; labellum deep purple, with a yellow throat. Var. **moràda.** This is a name under which importations of large, highly colored forms of *L. anceps* were sold by the Liverpool Hort. Co., Eng., as var. *grandiflora.*

10. **rubéscens,** Lindl. (*L. acumindta,* Lindl. *L. pedunculàris,* Lindl.). Pseudobulbs ovate to subrotund, clustered, sometimes rugose, 1-lvd.: lvs. oblong to lance-oblong, emarginate, 4–5 in. long: scape slender, jointed, sheathed with brown scales at the joints, 1 ft. long, with 2–8 graceful, fragrant fls.: sepals spreading, linear-oblong, acute; petals slightly longer and twice as wide, undulate; labellum as long as the petal; middle lobe of the same form but more undulate and with a stain of yellow on the disk, purplish red on the inner surface. A slender, graceful plant with small, whitish, lilac-tinted or rose-colored fls. B.M. 4905 and 4099. B.R. 26:41; 27:24; 31:69. F.S. 1:9; 7:742. P.M. 10:49.—Flowers much smaller than *L. anceps.*

GROUP II.

A. *Pseudobulbs ovate, evidently thickened.*
  B. *Lip with about 7 undulate keels*..11. **Jongheana**
  BB. *Lip without or with plane keels*.. 2. **grandiflora**
AA. *Pseudobulbs oblong, more stem-like.*
  B. *Fls. greenish yellow*..............15. **glauca**
  BB. *Fls. bright colored or white.*
    C. *Labellum firm, fleshy; lateral lobes convolute over the column*........................12. **pumila**
    CO. *Lateral lobes of the lip resting on the middle lobe*...........13. **Leeana**

11. **Jongheàna,** Reichb. f. Rhizome with remarkably thick root-fibers: pseudobulbs ovate-oblong, 1-lvd.: lvs. broadly oblong, 3–5 in. long, very thick and dark green: scape stout, shorter than the leaf, 1–2-fld.: fls. 4 in. in diameter, bright amethyst color; sepals linear-lanceolate, acute; petals broadly oblong-obtuse; labellum convolute; lateral lobes very shallow; middle lobe emarginate, white and crisp, with about 7 golden yellow undulate ridges in the throat. Braz. B.M. 6038. R.H. 1873:290. G.C. 1872:425.—A dwarf species with remarkable leathery lvs. Said to equal *L. grandiflora* and *Cattleya Mossiæ.* Rare in cultivation.

12. **pùmila,** Reichb. f. (*Cattlèya pùmila,* Hook. *C. margindta,* Paxt. *Lælia præstans,* Lindl. & Reichb. f. *L. Daydna,* Reichb. f. *L. Pinélii,* Hort.). Pseudobulbs small, stem-like, with one oblong to linear-oblong leaf 5–6 in. long: peduncle shorter than the lvs., each bearing a single, large, drooping, rose-purple fl.: sepals oblong, acute; petals ovate-oblong, broader, undulate; labellum very involute; lateral lobes subquadrate, middle lobe short, emarginate, waved and crisped;

throat yellow, apex rich purple. A pretty dwarf species from Bras. B.M. 3656 and 5498. P.M. 10:265. F.M. 1877:249. B.R. 30:5. F. 1850:89 (*Cattleya spectabilis*). G.C. II. 23:597.—Many variations of this plant have been described as distinct species, although botanically but one species. Some of them are well-marked horticultural varieties. Var. **præ̀stans**, Veitch (*L. præstans*, Lindl. & Reichb. f.). A large-fld., highly-colored variety, with the sepals and petals much broader than in the type; labellum rich purple, very rigid and fleshy, lines almost obsolete. B.M. 5498. Gn. 53, p. 550. Var. **marginàta**, Hort. (as *Cattleya marginata*, Paxt.). Fls. large; sepals and petals rose-crimson; labellum with a white border, crisp. Bras. P.M. 10:265. I.H. 6:193 (as *Cattleya pumila*, var. *major*, Lem.). F.S. 18:1900. G.C. III. 22:262. A.G. 11:158. Var. **Dayàna**, Dean (*L. Dayana*, Reichb. f.). Sepals and petals rose-purple; labellum with a deep purple margin. Earlier than the type. Bras. R.H. 1890, p. 490. F.M. 1877:249. Var. **alba**, Hort. Fls. like var. *præstans*, but pure white with the base of the lip yellow. G.C. III. 21:11. J.H. III. 34:27.

13. **Lesàna**, Reichb. f. Hybrid: pseudobulbs cylindrical, somewhat swollen, 1-lvd.: lvs. cuneate-oblong, very coriaceous: sepals and petals spreading, ligulate, acute, somewhat undulate, rose color; lateral lobes of the labellum semi-ovate, acute, the tips resting on the middle lamella, white, tips purple; middle lobe broad, obcordate. Sept. "Natural hybrid of *L. marginata* and ———?" *Hansen.*—As this plant has 4 pollinia, it is probably nearer Cattleya. It was imperfectly described by Reichb. as a doubtful hybrid.

GROUP III.

A. *Fls. greenish yellow.*

B. *Labellum deeply fringed on the margin* .... 14. **Digbyana**

BB. *Labellum not fringed.*

D. *Evidently 3-lobed* .... 15. **glauca**

DD. *Obsoletely 3-lobed* .... 16. **virens**

AA. *Fls. all yellow* .... 17. **xanthina**

AAA. *Fls. with only the sepals and petals tawny yellow; labellum some other color* .... 18. **grandis**

AAAA. *Fls. purple, rose or white.*

B. *Labellum with several prominent toothed crests* .... 19. **superbiens**

BB. *Labellum destitute of crests.*

C. *Petals and labellum waved and crisped.*

D. *Fls. uniformly purple* .... 20. **Boothiana**

DD. *Fls. white and purple.*

E. *Lip ovate-acuminate* ... 21. **crispa**

EE. *Lip rounded* .... 22. **purpurata**

CC. *Sepals and labellum plane, or nearly so* .... 23. **Perrinii**

14. **Digbyàna**, Benth. (*Brassávola Digbyána*, Lindl.). Pseudobulbs elongate, stem-like, 1-lvd.: lvs. elliptical, thick, fleshy, plane, slightly keeled: peduncle with a solitary, very large, fragrant flower 3–5 in. across: sepals and petals similar, oblong, spreading, pale purplish green; petals slightly broader; labellum very large-cordate, entirely surrounding the column, white or cream-colored, with the margin cut into a broad laciniate fringe, which makes the flower very striking. July, Aug. Honduras. B.M. 4474. B.R. 32:53. F.S. 3:237. G.C. III. 18:153.—A slow-growing orchid.

15. **glaùca**, Benth. (*Brassávola glaùca*, Lindl.). Stem short, creeping: pseudobulbs short, oblong, stem-like, compressed and sheathed with scales, bearing a single oblong glaucous, very thick and leathery leaf: fls. usually single, on a stalk shorter than the leaf, fragrant; sepals and petals spreading, oblong-lanceolate, obtuse, greenish yellow; labellum with a short claw surrounding the column, then expanding into a large 3-lobed limb, yellowish white, streaked with red in the throat. Mex. and Guat. B.M. 4033. B.R. 26:44. G.C. III. 7:357.

16. **virens**, Lindl. Plants about 6 in. high: fls. 1 in. across; sepals suberect, ovate; petals lanceolate, subequal; labellum obsoletely 3-lobed, cucullate; apex ovate, crisp, with obscure raised lines toward the base. The fls. are pale yellowish green of no beauty. Brasil.

17. **xanthina**, Lindl. Lvs. oblong, longer than the fusiform pseudobulb: raceme 3–5-fld.: fls. 3 in. across, buff-yellow except the lip, which is white in front streaked with crimson-purple; sepals and petals subequal, oblong-obtuse, undulate, leathery and convex; labellum nearly quadrate when spread out, without raised veins. Brazil. Int. 1858. B.M. 5144. F.S. 23:2418.—A second-rate species.

18. **grándis**, Lindl. & Paxt. Pseudobulbs stem-like, 1-lvd., 1 ft. high: lvs. rigid, oblong-lanceolate: scape erect, bearing 2–5 fls. 4 in. across: sepals and petals lanceolate, the latter a little broader, slightly curled or twisted; labellum white; front lobe large, bell-shaped, crenate-toothed, veined with purple. Spring. Brazil. B.M. 5553. F.S. 7, p. 238 and 23:2473.—A curious species with the sepals and petals colored tawny yellow, contrasting strongly with the whitish purple-veined lip. Var. **tenebròsa**, God. Lebeuf. Sepals and petals citron-yellow, less undulate; labellum trumpet-shaped, purple, with a broad border of white with many purple veins. G.C. III. 14:221. G.M. 36:531.

19. **supérbiens**, Lindl. Pseudobulbs 1 ft. or more in length, oblong, with one or two coriaceous oblong lvs. equaling the pseudobulbs in length: scape drooping, 5–6 ft. long, bearing a globose cluster of 10–20 fls. each about 6 in. in diam.: sepals and petals nearly equal, spreading, oblong-lanceolate, obtuse, lilac-purple, paler below; labellum as long as the segments; middle lobe broad obcordate, waved and crisp; disk with several prominent toothed crests, yellow, deep crimson-purple on the margins; side lobes yellow with purple margins and stripes. Guatemala. B.M. 4090. F.S. 11:1178–79. P.M. 11:97. R.H. 1886:324.—A very large plant.

20. **Boothiàna**, Reichb. f. (*L. lobata*, Veitch. *Cattlèya lobàta*, Lindl.). A strong-growing plant: pseudobulbs clavate, furrowed, 1-lvd.: lvs. lanceolate-oblong, about as long as the scape: scape 8–10 in. long, from the axil of the leaf, 2–5-fld.: fls. about 5 in. across, uniformly violet-purple with rich crimson veins on the lip; sepals lanceolate, with reflexed margins; petals broad, oblong, undulate, crisp; labellum cucullate, the middle lobe reflexed, all beautifully waved and crisped. Much like *L. crispa* in habit. Apr., May. S. Brazil. R.H. 1874:331 (*L. Rivieri*, Carr.). G.C. 1848:403 and III. 10:577. F.S. 20, p. 132. A.G. 13:608.—This plant is not free-flowering, hence it is little cult., although a beautiful and distinct species.

21. **crispa**, Reichb. f. (*Cáttleya crispa*, Lindl.). Pseudobulbs clustered, elongate-clavate, 1-lvd.: lvs. large, 1 ft. long, oblong-lanceolate, emarginate: scape with 5–6 large, handsome, fragrant fls.: sepals linear-oblanceolate or spatulate, acute, margins revolute; petals much broader, with the margins beautifully waved and crisped; labellum standing forward, recurved at the apex; side lobes rounded, white, yellow at base, streaked with red; middle lobe long, ovate-acuminate, deep purple inside, veined, all remarkably waved and crisped. Summer. On lofty trees, fully exposed. Brazil. B.M. 3910. B.R. 14:1172. Gn. 48, p. 504. J.H. III. 33:197. P.M. 5:5.—A fine white-fld. species resembling a Cattleya in habit. Var. **Cauwelærtiæ**, L. Linden. Sepals and petals tinged with greenish yellow; base of labellum yellow. I.H. 38:121.

22. **purpuràta**, Lindl. & Paxt. Fig. 1224. Pseudobulbs long-elliptical, 6–8 in. high: lvs. solitary, oblong, leathery, dark green, 1 ft. or more in length: scape erect, 3–7-fld.: fls. very large, 6–8 in. across; sepals linear-oblong, spreading, white, suffused with light rose; petals much broader, ovate, undulate crisp, base attenuate, colored like the sepals; labellum very large, bell-shaped; middle lobe rounded, undulate-crisp, rich purple with darker veins, throat yellow. A robust plant, whose large fls., borne on strong, erect stalks, make it one of the grandest Lælias in cultivation. Spring. Brazil. I.H. 1, p. 54, and 3:83. F.S. 11:1138–39. Gn. 54, p. 17 and 56, p. 46 (var. Mrs. Measures). G.C. II. 14:45 and 20:533. A.F. 6:223.—Var. **atropurpùrea**, Williams. Sepals and petals deep rose; labellum large, expanded, purple-magenta; throat yellow, veined with purple. Brazil. Var. **Ashworthiàna**, J. Anders. Petals wider than in the type, 2 in. wide, purplish rose, with darker stripes. A highly colored form. G.C. III. 20:39. Var. **Nélisii**, Hort., Verschaff. Sepals and petals subsessile,

the former rose-colored outside; midlobe of the labellum ovate, acute. Much like the type in color. I.H. 15:569. Var. **Russelliàna,** Williams (*L. Russelliàna*, Hort.). Fls. large; sepals somewhat narrow, white, suffused with lilac; petals broader, deeper lilac; labellum large, rose-lilac; throat yellow, marked with rose. Autumn. Var. **Schrœderi,** Reichb. f. Sepals and petals white; labellum white, with a tinge of rose in the center; tube pale yellow, with fine, dark purple lines. I.H. 38:139. Var. **Mandaiàna,** Hort. Pseudobulbs thinner and narrower than in the type: fls. as large as those of the type, pure white, with a faint tinge of pink on the labellum. Var. **prætéxta,** Reichb. f. No description of this plant is available.

1224. Lælia purpurata (× ⅙).

23. **Pérrinii,** Lindl. (*Cáttleya Pérrinii*, Lindl.). Pseudobulbs elongate: lvs. solitary, oblong, coriaceous, 8 in. long, equaling the stem: fls. showy, 2–3 on a short stalk; sepals oblong-linear, obtuse; petals a little broader, all rose-purple, darker at the tips; middle lobe of labellum cucullate, expanded, oblong, obtuse, undulate, with an inflated fistular cavity at the base, destitute of ridges, color deep crimson; lateral lobes erect, acute, pale. Oct.–Dec. Brazil. B.M. 3711. B.R. 24:2. P.M. 13:5. G.M. 37:717. A.F. 13:1196.—Fls. rather pale. Var. **álba,** O'Brien. Fls. white, with the labellum tinged with yellow. There are several pale varieties of this plant.

GROUP IV.

A. *Lvs. solitary.*
  B. *Scape 1-fld*......................24. **monophylla**
  BB. *Scape several-fld*................25. **harpophylla**
AA. *Lvs. usually 2*......................26. **cinnabarina**

24. **monophýlla,** N. E. Brown. Rhizome a matted mass sending up tufts of leaf- and flower-stems: flowering stems 6–10 in. long, as thick as a crow-quill, rigid and erect, bearing a single linear-oblong, obtuse leaf 2–3 in. long, and several sheathing bracts: fls. 1–2 in. across, vivid orange-scarlet; sepals and petals similar, spreading, oblong, subacute; labellum very small, lateral lobes embracing the column, terminal minute papillose on the disk. Mts. of Jamaica, growing on trees at elevations of 3,000–5,000 ft. B.M. 6683.

25. **harpophýlla,** Reichb. f. Hybrid much like *L. cinnabarina*. Pseudobulbs slender, about 10 in. long, each bearing a single lance-linear leaf: raceme short, suberect, bearing 5–10 brilliant scarlet-orange fls.: sepals and petals oblong-lanceolate, acute; middle lobe linear, acuminate, crisp, with a whitish spot. A luxuriant free-flowering species. Feb., March. Brazil. Gn. 24:400. F.M. 1879:372.—Probably a hybrid between *L. cinnabarina* and a Brassavola(?) Reichb. f.

26. **cinnabarìna,** Batem. Pseudobulbs elongate, cylindrical, but broadest at the base, sheathed with scales, bearing 1–2 linear-oblong, reflexed, acute, coriaceous lvs.: raceme terminal, erect, 15–20 in. long, with 4–5 medium-sized reddish orange fls.: sepals and petals linear-oblong, obtuse, spreading; labellum convolute, reflexed; lateral lobes acute, middle lobe large, oval, crisp. Brazil. B.M. 4302. P.M. 7:193.—A summer-flowering species whose peculiar color and graceful habit render it very ornamental. Var. **crispilàbia,** Veitch (*L. crispilabia*, A. Rich. *L. Lawrenceàna*, Hort.). Fls. amethyst-purple; labellum darker, finely crisp and undulate: raceme 12–14 in. long, bearing 3–5 fls. A pretty, free-flowering variety.

Lælia Latòna, Hort. Veitch. Sepals and petals light orange-yellow: labellum whitish at base, the rest purple bordered with orange-yellow: middle lobe much undulated. A garden hybrid between L. cinnabarina and L. purpurata. Not advertised in America. A. Pericat, Philadelphia, writes as follows of this plant: "Lælia Latona, raised by Veitch, is a beautiful hybrid Lælia of a distinct and unusual color from L. purpurata × L. cinnabarina, the latter being the seed parent. The sepals and petals are of light orange-yellow; lip whitish at the base, the remainder red-purple bordered with orange-yellow, the margin of the apical spreading; lobe is much undulated."

HEINRICH HASSELBRING.

Lælias may be divided into three cultural groups: (1) those which have clavate pseudobulbs and which bear a nearer affinity to Cattleya than the others; (2) those with long, rounded, slender stems, and (3) those with pseudobulbs more or less pyriform in shape.

Those of the first group should be placed amongst the warmer-growing Cattleyas. Examples are *L. purpurata*, *L. grandis*, *L. Digbyana*, *L. glauca* and *L. Boothiana*. Those of the second, or slender-bulbed group, succeed in a much cooler and shadier spot, and need more moisture, both in the atmosphere and at the roots. Examples are *L. pumila*, *L. harpophylla* and *L. monophylla*. Of the group with pear-shaped bulbs, *L. anceps*, with its numerous varieties, is perhaps the best known. Others are *L. autumnalis*, *L. majalis* and *L. albida*. To these may be added such species as *L. cinnabarina*, *L. flava*, and some few others of similar habit. These require at all times a sunny, airy position, with abundance of overhead watering during their period of growth, and after flowering a severe resting period, the one great object being to keep them inactive for as long time as possible. *L. autumnalis* and *L. majalis* require somewhat different treatment, since they flower from an incompleted bulb, and should, therefore, receive attention until the bulbs are solid, when the drier condition must be observed.

The best method for cultivation of specimens of the first group is to pot them in the ordinary flower-pot, but for very large specimens a basket is preferred as a more ready means of carrying off the water and affording better and sweeter conditions for the roots. The potting material should be composed of about two-thirds good peat or fern root and the remainder fresh sphagnum moss. The cultivator should use good judgment as to when to water the plants. No hard and fast rules can be laid down in regard to this. More can be accomplished by watchfulness than ever can be written.

The slender-bulbed species require about equal parts of peat and moss. Such species as *L. pumila* do best in rather small pans and may be suspended from the roof. All these thin-bulbed species enjoy shade rather than direct sunlight. More moisture is essential both atmospherically and at the roots, and at no season should it be withheld for very long periods. Watch carefully for any symptom of suffering from lack of water.

The Mexican Lælias do best with a smaller quantity of moss and peat, and thrive best when put up in baskets or cribs. They enjoy a great amount of direct sunshine, and should have during the time of active growth an almost unlimited supply of water, which is best supplied to them after the sun begins to lose its power. At this time it comes as a welcome, refreshing bath. A good syringing in the early morning is needed to help the plant through the day. With such treatment plenty of strong flowers must result. *L. cinnabarina*, *L. flava* and allied kinds enjoy the above treatment equally well. Many beautiful hybrids have been raised in gardens, and the needs of each from a cultural view will be best obtained by noting to which section or group they belong, and giving the treatment recommended for such.

A really good selection of Lælias for the adornment of the orchid house is herewith appended: *L. anceps* and its varieties, *alba*, *Dawsonii*, *Hilliana*, *Sanderiana*, *stella*, *rosea*, *Veitchii*, *Williamsii*, *Schrœderiana* and *Amesiana*, all of which have pure white sepals and petals and various colored labellums; *Scottiana* and *grandiflora*, distinguished for size; and a wonderful peloriate form known as *Rœblingianum*. *L. albida*, *autumnalis*, *cinnabarina*, *flava*, *pumila*, *Dayana*, *præstans*, *Dormaniana*, *grandis*, *Lindleyana*, *majalis*, *tenebrosa*, *monophylla*, *harpophylla*, *Perrinii*, *purpurata*, *superbiens*, *xanthina*. In some species almost endless variety occurs, notably so with *L. purpurata*, *Perrinii* and *albida*, and pure white varieties are known in many of the rarer species.

HENRY T. CLINKABERRY.

LÆLIOCATTLÈYA. A name proposed by R. A. Rolfe to designate the bigeneric hybrids of Lælia and of Cattleya, which readily hybridize. The species of the two genera have 8 and 4 pollen masses respectively, while the hybrids are irregular in this respect. Many of the plants are natural hybrids, and many others have been produced by artificial crossing. For a list of Læliocattleyas, see Rolfe in G. C. III. 6:78, 155. In the following account L=Lælia; Lc=Læliocattleya; C=Cattleya.

H. T. Clinkaberry writes that the cultivation of Læliocattleyas is the same as for Lælia and Cattleya. It is therefore important to know the parentage in each case, from which one may know whether warm or coolhouse treatment is needed. He adds that many Læliocattleyas are of such a vigorous constitution that they are nearly always in growth.

INDEX.

alba, 13.
amanda, 2.
Andreana, 7.
Brysiana, 1.
callistoglossa, 5.
Corbeillensis, 3.
Dominiana, 6.
Dominyana, 6.
Dormaniana, 16.
Duvaliana, 10.
elegans, 1.
eximia inversa, 11.
Exoniensis, 17.
intermedio-flava, 15.
Nylephtha, 1.
Martineti, 12.
prasiata, 1.
radiata, 9.
Sallieri, 8.
Schilleriana, 13.
Stelzneriano-Hardyana, 4.
Turneri, 1.
velutino-elegans, 14.

A. *Fls. light or bright rose* .... 1. **elegans**
2. **amanda**
3. **Corbeillensis**
4. **Stelzneriano-Hardyana**
5. **callistoglossa**

AA. *Fls. rose-purple, mauve, violet, etc*.. 6. **Dominiana**
7. **Andreana**
8. **Sallieri**
9. **radiata**
10. **Duvaliana**
11. **eximia inversa**
12. **Martineti**

AAA. *Fls. white or whitish, or yellow*.......... 13. **Schilleriana**
14. **velutino-elegans**
15. **intermedio-flava**

AAAA. *Fls. olive-brown* .... 16. **Dormaniana**

AAAAA. *Fls. tinted light blue*. 17. **Exoniensis**

1. **élegans**, Rolfe (*Lǽlia élegans*, Reichb. f. *Cáttleya élegans*, Morren). Pseudobulbs terete, stem-like, 15–20 in. high: lvs. solitary, linear-oblong, coriaceous, 10–12 in. long: scape short, stout, 3–7-fld.: fls. 5 in. in diam., light or bright rose, fragrant; sepals oblong, acute, often somewhat twisted or with revolute edges; petals much wider, lanceolate, margin somewhat undulate; labellum with the lateral lobes elongate-obtuse, whitish with purple apices, convolute over the column; middle lobe broadened in front, subreniform, margin undulate, crisp, entirely a very deep purple, without raised lines or callosities. May–Sept. Brazil. B. M. 4700. I. H. 4:134 (as *L. Brysiana*); 11:402.—A showy, tall-growing species.

Var. **Nyléptha**, O'Brien. Fls. large; sepals tinted with yellow and rose, lightly spotted with purple toward the tips; petals broader, more suffused with purple; lip bright purple in front, paler at the side lobes. G.C. III. 3:176.

Var. **Túrneri**, Warn. Fls. large, richly colored; sepals and petals bright amethyst-purple, with deeper veins; lip with a large purple blotch on the middle lobe; side lobes white, tipped with rose. Gn. 47, p. 319; 49:1067 and p. 385.—One of the finest of the genus.

Var. **prasiàta**, Reichb. f. Sepals and petals rose, tinged with green: labellum white at the base and side lobes, middle lobe crimson-purple.—Var. *superbum* is advertised.

2. **amánda**, Rolfe (*Lǽlia amánda*, Reichb. f.). Natural hybrid between *C. intermedia* and perhaps *Lælia crispa*. Pseudobulbs thin, fusiform, 5–7 in. long, 1–2-lvd.: lvs. shorter than the pseudobulbs, cuneate-oblong, acute: fls. in pairs, from a small, narrow spathe; sepals oblong-ligulate, acute, light rose, with a grayish hue outside, wavy; petals similar but broader, with darker tinted nerves on the inside; lateral lobes of the labellum enveloping the column, rich dark purple; middle lobe transversely oblong, short, emarginate, wavy, separated from the others by an exceedingly short isthmus, veined with rich purple. Brazil. I.H. 38:135.

3. **Corbeillénsis**, Maron. Garden hybrid of *C. Loddigesii* and *L. pumila*, var. *marginata*. Pseudobulbs 5–6 in. long, fusiform: lvs. about 6 in. long: fl.-stalk 2–3 in. long, bearing 1–2 showy fls. about 5 in. across: sepals and petals bright rose, the latter veined with deeper purple lines; throat of the labellum veined with yellow on a white ground; blade intense purple, bilobed and undulate.

4. **Stélzneriàno-Hardyàna**, Maron. A garden hybrid of *Lc. elegans*, var. *Stelzneriana* and *Cattleya Hardyana*. Plants vigorous: pseudobulbs 7–8 in. long: lvs. 10 in. long by 2½ in. wide: sepals pale clear rose, deeper on the edges; petals undulate, rose on the margins, fading almost to white at the center; labellum purple-magenta, undulate lacerate on the margin, with a broad purple line in the center of the blade and 2 large white spots in the throat.

5. **callistoglóssa**, Rolfe (*Lǽlia callistoglóssa*, Reichb. f.). Garden hybrid of *L. purpurata* and *Cattleya labiata*, var. *Warscewiczii*. Pseudobulbs as in *L. purpurata:* lvs. 12 in. long: petals broad, oblong, acute; sepals narrower, all pure rose; middle lobe of the labellum broad, retuse, dark purple, with yellow on the disk; side lobes small obtuse-angled.

6. **Dominiàna**, Rolfe (*Lǽlia Dominyàna*, Reichb. f.). Garden hybrid. Plants having the general habit of *Cattleya Mossiæ:* pseudobulbs fusiform, rather short, 1-lvd.: lvs. linear-oblong: raceme bearing few large, handsome fls.: sepals narrowly oblong, acute, light purple, with dark reticulations; petals broadly cuneate-oblong, wavy, light purple; labellum cucullate, with the middle lobe large, spreading, all wavy and crisp, deep blackish purple. F. M. 1878:325. Raised for Veitch by Mr. Dominy from a cross between *Cattleya Dowiana* and some Lælia,—according to Reichenbach, *Lælia* (*Læliocattleya*) *elegans*. Mr. R. A. Rolfe suggests the more probable parentage of *Cattleya Dowiana* and *Lælia lobata*. The first plant flowered in August, 1878.

7. **Andreàna**, Maron. A garden hybrid between *C. bicolor* and *Læliocattleya elegans*. Pseudobulbs 8–12 in. long, stem-like: lvs. oblong, 6 in. long: fls. 6–7 in. across, rose-violet; sepals and petals spreading, narrowly oblong, with the margins recurved, those of the

petals undulate; labellum contracted in the middle, with a subquadrate toothed and undulate middle lobe, violet-purple. R.H. 1896:328.

8. **Sallièri**, Maron. Garden hybrid between *Lælia purpurata*, var. *Williamsi*, and *Loddigesii*. Pseudobulbs 1–2-lvd., about 10 in. high : lvs. 8 in. long, 3 in. wide: fls. several on a stalk, which is shorter than the lvs., 5–6 in. across ; sepals and petals mauve, with deeper lines ; labellum tubular, colored like the segments, and expanding into a carmine blade, pale at the tip.

9. **radiàta**, Maron. Garden hybrid of *Lælia purpurata* and *C. nobilior*. Pseudobulbs almost round, bearing 1–2 coriaceous lvs. 7 in. long by 2½ in. wide: fl.-stalks about 7–8 in. long, bearing several large, showy, violet-red fls.; labellum deep red, with purple veins and a whitish throat.

10. **Duvaliàna**, Hort. Hybrid between *L. purpurata* and *C. Luddemaniana*. Sepals and petals half-spreading, light mauve; labellum broad, dark maroon-crimson on the lobes and in the throat, which is traversed by darker lines.—According to Arnold & Co., handsome flower of striking appearance.

11. **eximia invérsa**, Hort. Hybrid between *L. purpurata* and *C. Warneri*, the inverse cross of *Lc. eximia*. Sepals and petals deep rose-purple; labellum bright magenta-crimson.—Said by Arnold & Co. to be one of the finest hybrids yet raised between these genera, resembling *C. Warneri*.

12. **Martinéti**, Maron. Garden hybrid between *Cattleya Mossiæ* and *Lælia grandis*, var. *tenebrosa*. Fls. resembling those of the *Cattleya labiata* group ; sepals and petals rose-violet; labellum red to mauve, pale at the margins, and netted with numerous deep red veins.

13. **Schilleriàna**. Rolfe (*Lælia Schilleriàna*, Reichb. f.). Lvs. 8 in. long : fl.-stems 20 in. long : sepals and petals white, elongate-lanceolate; labellum veined with purple on the throat; disk purplish yellow, middle lobe spotted crimson-purple. A natural hybrid between *C. intermedia* and *Lc. elegans*. Brazil. Var. **álba**, Hort. Petals and sepals pure white; middle lobe of the labellum rich carmine-magenta, presenting an agreeable contrast. June, July. I.H. 31:526. Gn. 17:218.

14. **velùtino-élegans**, J. O'Brien. Garden hybrid of *C. velutina* and *Lc. elegans*. Resembles in habit a stout form of *Cattleya velutina:* fls. fragrant, 3–4 on an upright stem; sepals and petals creamy white, tinged with nankeen-yellow and veined with rose; labellum bluish white at base, side lobes folded over the column; middle lobe broad, toothed and crisp on the margin, rich crimson-purple, veined with white and having an orange blotch at the base.

15. **intermèdio-flava**, Maron. Garden hybrid of *C. intermedia* and *L. flava*. Of medium habit: sepals and petals clear yellow; labellum with a bright rose-purple blotch in front.

16. **Dormaniàna**, Rolfe (*Lælia Dormaniàna*, Reichb. f.). Natural hybrid of *C. bicolor* and *L. pumila*. Pseudobulbs terete, thin, slender, about 1 ft. long, 1–2-lvd.: lvs. oblong-ligulate, acute: peduncle 2–5-fld.: petals and sepals narrow oblong-ligulate, olive-brown, marbled outside with wine-red spots; labellum light purplish white, with darker veins; middle lobe transversely obcordate, mauve-purple. Brazil.

17 **Exoniénsis**, Rolfe (*Cáttleya Exoniénsis*, Reichb. f.). Garden hybrid probably between *C. labiata* and *L. crispa*. Sepals ligulate acuminate ; petals oblong-cuneate, plicate, all tinted light blue; labellum undulate, crisp, deep orange at base with whitish side lobes; middle lobe rich purple, with darker veins.

L. Aclándiæ (L. purpurata and C. Aclandia), is also advertised.

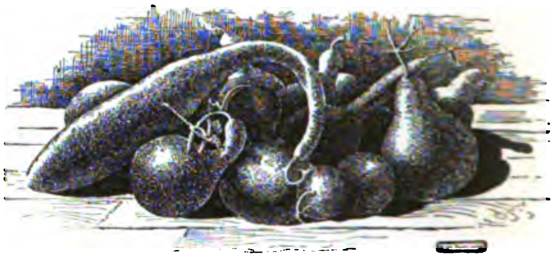
H. HASSELBRING.

LAGENÀRIA (Latin, *lagena*, a bottle). *Cucurbitàceæ*. GOURD. CALABASH. **L. vulgàris**, Ser., is the only species, now grown or spontaneous in all warm countries, originally from tropical Africa and Asia. It is exceedingly variable in its fruit, and has received many species-names as *L. microcarpa*, R.H. 1855:61; *L. clavata ; L. pyrotheca*, R.B. 23, p. 198; *L. virginalis*, white-fruited, G. C. III. 11:85 ; var. *longissima*, Gt. 48:159). The smooth, hard shells of the fruits are used for drinking cups, water jugs, and many domestic utensils. From the pear-shaped shell of a small-fruited form the Paraguayans drink their famous *maté*, or Ilex tea. The commonest forms are shown in the engraving (Fig. 1225). The long curved forms are often called snake gourds in this country (not to be confounded with snake cucumber, which is a Cucumis). These are sometimes several feet long. The form with a constricted middle is the bottle gourd. See *Gourd*.

Lagenaria is a tender annual, which should receive the culture of squashes. The season in the northern states and Ontario is often too short for the full maturity of the fruits, particularly if seeds have been brought from the South. Give a quick warm soil and sunny exposure. In the North, seeds may be started inside in pots, or on inverted sods, after the manner of cucumbers. The Lagenarias are rampant growers, often running 30–40 feet, and covering the ground or a fence with a dense mass of large, roundish, soft leaves. The plant has a musky odor and a sticky feeling.

Plant monœcious: fls. solitary, white, funnelform, very soft in texture, withering in the sun: staminate fls. on very long, slender stalks (usually exceeding the leaf): pistillate fls. mostly short-stalked, with 3 2-lobed stigmas and hairy ovary: tendrils forked, long and slender: stem striate-gròoved, soft-hairy: lvs. large, soft-pubescent, cordate-ovate or reniform-ovate, sometimes angled, the edges obscurely apiculate-sinuate, on prominent or long petioles. To this species belong the gourds known in this country as Hercules' Club, Sugar Trough, Dipper, Snake, Calabash, Bottle, Miniature Bottle, Depressa. In some countries, the young fruit is eaten as we eat summer squash. Monogr. by Cogniaux, DC. Monogr. Phaner. 3:417.

L. H. B.



1225. Various forms of gourds, Lagenaria vulgaris.

LAGERSTRÒEMIA (Magnus N. Lagerstrœm, 1696–1759, a Swede and friend of Linnæus). *Lythràceæ*. The Crape Myrtle, *Lagerstrœmia Indica*, is to the South what the lilac and snowball are to the North—an inhabitant of nearly every home yard. It is a strong-growing shrub, reaching a height of 10–25 ft., deciduous-leaved, producing an abundance of soft-fringed flowers in spring and summer. The normal form has pink flowers, but varieties with blush, white and purple fls. are not uncommon. It is hardy as far north as Baltimore, but north of that latitude it needs protection; even with protection it can not be grown north of the Long Island region.

Lagerstrœmia is a South Asian genus of nearly 20 species of shrubs and trees. The lvs. are opposite or the uppermost alternate, mostly ovate, entire: fls. in axillary and terminal panicles, the pedicels bracted: calyx with a funnel-shaped tube and 6–9 lobes; petals mostly 6, crinkled or fringed, with a long, slender claw (Fig. 1226); stamens many, long, some of them upward-curved: ovary 3–6-celled, with a long, bent style and capitate stigma: fr. a capsule; seeds winged at the top.

Índica, Linn. CRAPE MYRTLE. Fig. 1226. Glabrous brown-barked shrub, with rather small (2 in. long) elliptic or oblong sessile mostly acute lvs.: panicle open, sometimes minutely pubescent: calyx not ribbed, glabrous or nearly so. Widely cult. in India, but probably native to China. B.M. 405. R.H. 1857, p. 627; 1874:130. Gng. 1:151; 5:281. A.F. 9:85. G.M. 36:449.—Common everywhere in the South, particularly in the pink, blush and white forms. It can be prop. readily by cuttings of the ripe wood. In the N., the plants may be lifted in the fall and kept in a cellar. In spring they may be planted out, or flowered under glass. The Crape Myrtle blooms continuously for 2 or 3 months, beginning in June in the Gulf states. The bark is smooth, as if polished. Several named vars.

1226. Crape Myrtle, Lagerstrœmia Indica.
Natural size.

Flos-Reginæ, Retz. Tree, 50–60 ft., with elliptic or long-lanceolate obtuse lvs. 4–8 in. long: panicle large: fls. 2–3 in. across, varying from rose to purple from morning to evening, the calyx grooved, the petals erose-wavy: capsule 1 in. or more long. India. G.C. III. 15:77.—A noble plant in tropical India; also int. in S. Calif. In the Old World sometimes grown under glass.

L. H. B.

LAGUNÀRIA (named for its resemblance to Lagunæa, which is now considered a section of Hibiscus and commemorates a Spanish botanist, Andrés de Laguna, 1494 or 1499–1560, physician to Pope Julius III.). *Malvàceæ.* One species, an Australian tree cult. outdoors in S. Calif. and indoors in Europe. It has large, pale rose fls. like Hibiscus, 2⅛ in. across, with 5 spreading lobes, a column of stamens and a 5-lobed shield-shaped stigma. It differs from Hibiscus in having no bractlets or only 3, while Hibiscus usually has 5 or more. Lvs. entire, scurfy-tomentose: fls. axillary; calyx 5-toothed: ovary 5-celled.

Pátersonii, G. Don. About 12 ft. high, spotted brown on trunk and branches: lvs. ovate, entire, 2–3 in. long, dark green above, ashy gray beneath: peduncle 1⅛ in. long: corolla lobes ovate, covered with minute hairy scales inside, villous outside. B.M. 769 as (*Lagunæa Patersonia.*)

LAGÛRUS (Greek, *lagos*, a hare; *oura*, a tail). *Gramíneæ.* HARE'S TAIL GRASS. Contains a single species, native of the Mediterranean region, and cultivated for ornament, the small white heads being used for dry bouquets. Spikelets 1-fld., aggregated in a close panicle, forming an ovoid head; scarious empty glumes persistent and clothed with fine woolly hairs. Flowering glume with a dorsal awn. A hardy annual. Seeds sown in fall and plants set out in spring.

ovàtus, Linn. Culms about 1 ft. high, in bunches: lvs. and sheaths downy. R.H. 1890, p. 488. V. 3:217 and 247.

A. S. HITCHCOCK.

LAMÁRCKIA (J. B. Lamarck, 1744–1829, distinguished French naturalist, and author of the Lamarckian philosophy of organic evolution). *Gramíneæ.* Contains a single species, native from Mediterranean region to Afghanistan, and introduced in California. An ornamental annual grass, often cultivated under the name of *Chrysurus cynosuroides* and *C. aureus.* Spikelets of two sorts, fertile 1-fld., long-awned, surrounded by the long sterile spikelets of many obtuse glumes, arranged in a one-sided crowded panicle Seeds may be sown in the spring, or better in the fall and plants set out in the spring.

aùrea, Mœnch. Culms 6–12 in. high. R.H. 1890, p. 546.

A. S. HITCHCOCK.

LAMBKILL. *Kalmia angustifolia.*

LAMB'S LETTUCE. Consult *Corn Salad.* L. Quarter. *Chenopodium*, particularly *C. album.* Used as a pot-herb.

LÀMIUM (Greek for *throat*, referring to the shape of the corolla). *Labiàtæ.* DEAD NETTLE. About 40 annual and perennial herbs of the Old World, of which several run wild in this country as weeds and others are cult. as hardy border plants. Botanically, they are distinguished by a 2-lipped corolla, of which the tube is somewhat longer than the calyx, the upper lip ascending and concave, and the lower one 3-lobed: stamens 4, in 2 pairs, ascending under the upper lip: fls. in axillary or terminal whorls, often rather showy: lvs. opposite, mostly crenate-dentate and petiolate: calyx awl-toothed. Not to be confounded with Nepeta.

Lamiums are diffuse mostly pubescent or hairy herbs, commonly decumbent at the base and often almost trailing. They are of the easiest culture in any open soil. Useful for rockwork. The cult. kinds are perennial, and are commonly propagated by division.

maculàtum, Linn. (*L. álbum* and *L. purpùreum*, Hort., not Linn. *L. variegàtum*, Hort.). Straggling or half-trailing herb, the tips ascending, slightly hairy: lvs. long-petioled (except the uppermost), cordate-ovate, blunt, round-toothed: fls. 1 in. long, ascending in the clusters, the upper lip strongly arched or hooded, the tube 2–3 times longer than the calyx, hairy within. Eu.—Flowers usually purple-red, but sometimes varying to white (when it is known as *L. album*, but the *L. album* of botanists is a different plant, having pointed and sharp-toothed lvs.). The lvs. are usually whitish blotched along the midrib (var. *variegàtum*), and in this form it is common about old gardens, trailing in the waste places. The plant is also run wild. *L. purpureum* of the botanists is annual.

eriocéphalum, Benth. Stem much branched, glabrous: lower lvs. long-stalked, puberulent, small, orbicular, somewhat incise-crenate: floral lvs. larger, deeply toothed, sessile or nearly so: calyx villous; corolla 3–4 times longer than the calyx, straight, purple. Taurus.—Said by some to be annual.

Galeóbdolon, Crantz, of Europe, with yellow fls. and sometimes with yellowish foliage, is cult. in the Old World, but it has not appeared in the Amer. trade.

L. H. B.

LAMPROCÓCCUS. See *Æchmea.*

LANDRETH, DAVID, founder of the oldest seed-house in America, was born in 1752 at Haggerston, Northumberland county, England. He came to America late in the eighteenth century, making Philadelphia his home, and establishing there, in 1784, a nursery and seed business. Its location, on what was then known as High street, is now covered by the building 1210 and 1212 Market street. The raising of trees and production of seeds were conducted on land near by, particularly on a tract at Twelfth and Filbert streets. This locality proving too contracted for the purpose, the nursery and seed grounds were removed in 1789 to the "Neck," then considered far out of town, the place chosen being not far distant from the site of the present arsenal.

The subject of the present sketch, the younger David Landreth (Plate X), was born in Philadelphia in 1802. When of suitable age he entered actively into his father's business, which had considerably extended in Philadelphia, while a branch house had been opened in Charleston, S. C. The young man's early duty was that of manager of this Charleston branch. Of the Charleston business, it will suffice here to say that it continued till the era of the civil war, when it came to a sudden end by the act of the Confederate States District Court, which confiscated the real estate and merchandise alike, on April 22, 1862.

The younger David Landreth, in 1828, succeeded his father as proprietor of the well-established and thriving business in Philadelphia, a business which was to remain highly prosperous for half a century afterwards under his fostering care. His time, however, was not wholly occupied with the details of business, but was turned at an early age towards the literature of husbandry and to enterprises of public interest. Among the latter may be mentioned the Philadelphia Horticultural Society, of which, in 1827, he was one of the founders and a vice-president, and in 1828 was elected corresponding secretary, which office he held for seven years. At a subsequent date he was made president of the Philadelphia Society for the Promotion of Agriculture, and vice-president of the United States Agricultural Society, and became an active member of many other organizations.

His literary labors included the publication of the "Illustrated Floral Magazine," started in 1832, and an advanced work for that period. At a later date he wrote much upon husbandry, his graceful style as a writer and his technical knowledge of the subject making his views of much value in the progress of the industry. He edited an American edition of George W. Johnson's "A Dictionary of Modern Gardening," a volume of 635 pages, published at Philadelphia in 1847.

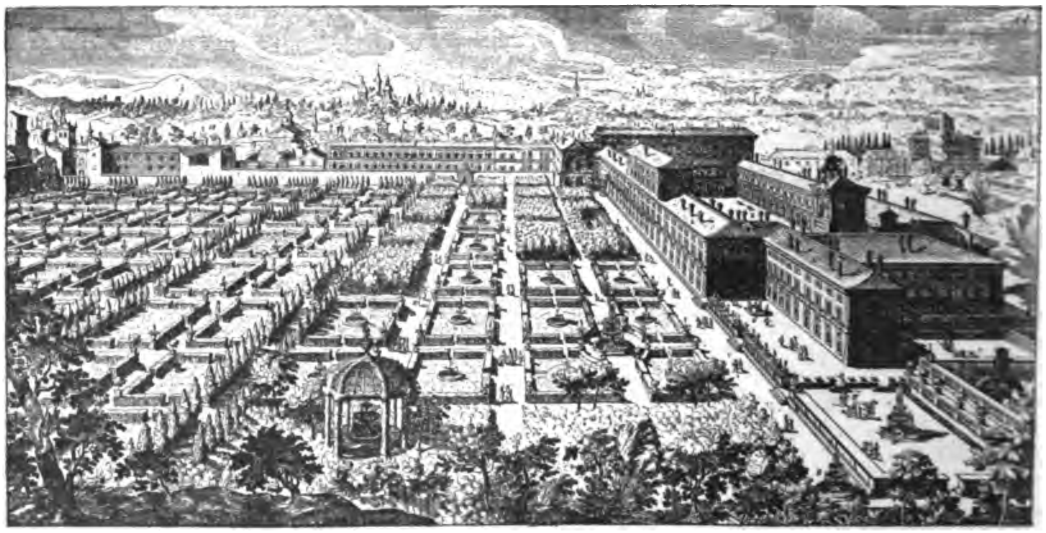
In 1847 the Landreth nursery was removed to Bloomsdale, where Mr. Landreth established what is believed to be the most complete seed-farm in the United States, and where he planted an arboretum which perhaps stands unequaled in this country in the development of its trees. He was an early breeder of the Channel Island cattle, then styled Alderneys, and was among the earliest manufacturers of mowing and reaping machinery. In 1872-73 he experimented in steam-plowing with a Scotch engine, and in the following year with an American engine. Subsequently, steam-digging and steam-chopping were experimented with at Bloomsdale, and many improvements produced in the machine shop of that model farm.

David Landreth lived until 1880 in the enjoyment and care of the business which had been so much developed in his hands, and which had reached almost its hundredth year. The firm is now one of the thirty centenary firms in the United States. During a long life he had served his country in connection with agriculture, a pursuit which he dignified by the wide respect he had gained as an old-school country gentleman, and his reputation as an able and learned agriculturist. In early life he had lived amid the plantations of the Landreth nursery, one of the show places of Philadelphia—the site now marked by the Landreth School—and his virtues and character were those of one brought up in intimate contact with nature. BURNET LANDRETH.

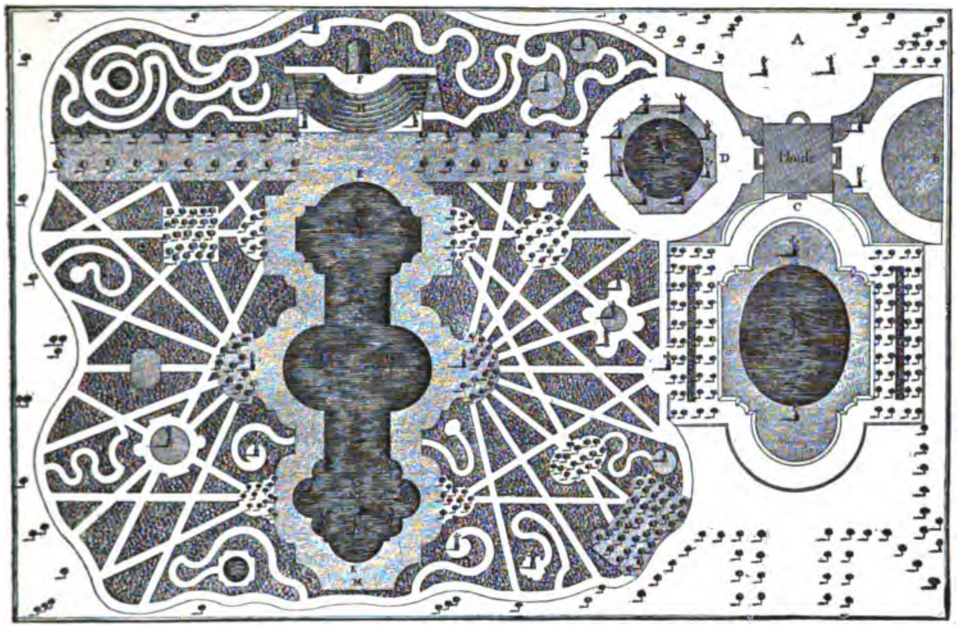
LANDSCAPE GARDENING. "Gardening may be divided into three species—kitchen gardening—parterre-gardening—and landskip, or picturesque gardening: which latter is the subject intended in the following pages—It consists in pleasing the imagination by scenes of grandeur, beauty, or variety. Convenience merely has no share here; any farther than as it pleases the imagination." These are the opening lines of "Unconnected Thoughts on Gardening," by the poet William Shenstone, 1764. These sentences gave the world the term Landscape Gardening, to embody the growing desire to make grounds like nature. Milton, Addison, Pope, and the Dutch painters, expressed the awakening to the charms of the external world and hastened the day of freedom and naturalness. These and others had protested, directly or indirectly, against the artificialisms of living, as Bacon, also, in the following sentence, had protested: "As for the making of Knots or Figures, with divers Colored Earths, they be but toys, you may see as good sights many times in Tarts. * * * * * * I do not like Images cut out in Juniper, or other garden-stuff; they are for Children."

One does not know what Shenstone's protest meant until he knows the style of gardening which had been and still was in vogue. Gardens were fantastic constructions, elaborate with designs and formalities, cramped with geometrical details. A Roman garden (Fig. 1227) was well enough in its place, but there are other conditions and other ideals. Only rarely can such gardens as these find the proper setting. If effective, they must be dominated or supported by architecture. In the freer atmosphere of the country, they are evidently artificial: they are conceits. The reader will catch the feeling of the formal gardens of a later time by looking at Fig. 1228, which is a reduction from one of Batty Langley's designs in his "New Principles of Gardening," 1728. Langley seems to have been the extremest of geometricians. In fact, Part I of his book on gardening treats "Of Geometry." Yet his plates suited the taste of the time. The particular plan which is shown in Fig. 1228 he describes as follows: "The House opens to the North upon the Park A, to the East upon the Court B, to the South upon the Parterre of Grass and Water C; and Lastly to the West upon the circular Bason D, from which leads a pleasant Avenue ZX. The Mount F, is raised with the Earth that came out of the Canal EE, and its slope H is planted with Hedges of different Ever-Greens, that rising behind one another of different Colours, have a very good Effect, being view'd from M. I, I, are contracted Walks leading up the Mount." The ideas of the time are further reflected in Fig. 1229, which is a reproduction, on a smaller scale, of one of Langley's pictures of artificial ruins. It is one of his "views of the Ruins of Buildings, after the old Roman manner, to terminate such Walks that end in disagreeable Objects; which Ruins may either be painted upon Canvas, or actually built in that manner with Brick, and cover'd with Plaistering in Imitation of Stone."

The awakening love of nature and of the spontaneous life, as expressed in writings and paintings, soon found expression also in gardens. In verse, Pope gave rules



1227. Gardens of the Pope, on the Quirinal, Rome. From Falda's "Li Giardini di Roma."



1228. One of Langley's "Designs for gardens that lye irregularly to the Grand House." 1728.

for the laying out of a spontaneous garden. The accompanying plan of Shenstone's garden, the Leasowes (Fig. 1230), and the picture of a glimpse therein (Fig. 1231), show how far his conceptions were removed from those of Langley, howsoever much they may fall short of the ideals of the present day. A full description has been left us of the Leasowes. Here is a glimpse: "Passing through a small gate at the bottom of the fine swelling lawn that surrounds the house, you enter upon a winding path, with a piece of water on your right. The path and water, over-shadowed with trees that grow upon the slopes of this narrow dingle, render the scene at once cool, gloomy, solemn, and sequestered; and forms so striking a contraste to the lively scene you have just left, that you seem all on a sudden landed in a subterraneous kind of region. Winding forward down the valley, you pass beside a small root-house, where on a tablet are these lines:

> 'Here in cool grot, and mossy cell,
> We rural fays and faeries dwell;
> Tho' rarely seen by mortal eye,
> When the pale moon, ascending high,
> Darts thro yon limes her quivering beams,
> We frisk it near these crystal streams.' "

The garden-art of the old time was largely a corollary of architecture. The garden-art of the present time, particularly amongst English-speaking peoples, exists for its own sake. Yet, one cannot say that the old-time garden-art is unlovely, or that it contradicts the canons of good taste. The two belong to different categories of æsthetic feeling, and the mere fact that both of them use plant-subjects does not make them comparable. Garden-art, like painting or music or literature, develops along racial or national lines. The Latins and their descendants have liked the formal and conventional gardens; and since these gardens express the personal and national emotions, they need no apology, notwithstanding the fact they are condemned by many landscape gardeners.

A different type of endeavor is that which attempts to interpret nature in the making of landscapes. The ideal landscape garden, like the ideal landscape painting, expresses or emphasizes some single thought or feeling. Its expression may be gay, bold, retired, quiet, florid; but if it is natural, its expression will conform to the place and the purpose, and the expressions are not matters of rule. It should be a picture, not a collection of interesting objects. Mere planting and grading do not make a landscape garden: in fact, they often spoil it. It is not enough to plant: the plants must be in the right place. A yard or a lawn with bushes or flower-beds scattered over it may be interesting as a mere garden, but it is not a landscape garden. The Italian gardens were hardly landscape gardens. A real landscape garden has open breadth, space, atmosphere. It usually has an open center with mass-planted sides, and vistas to the offscape. Incidentally, it may be ornamented; yet many persons even confound ornamental gardening with Landscape Gardening: it would be as proper to confound house-painting with architecture. Figs. 1227 and 1232 show the contrasts of a mere garden and a landscape garden. Compare Plates XIV and XV.

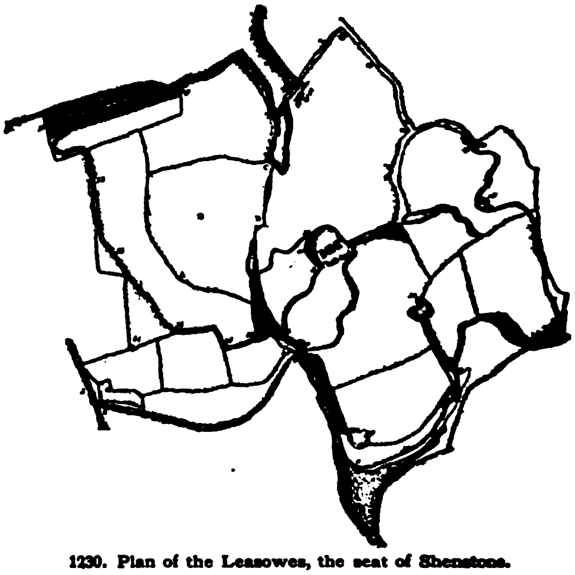
It will be seen from the above that the term Landscape Gardening precisely expresses the art of making a garden or tame area which shall be a landscape or picture. Yet, amongst the profession, the term landscape architecture is preferred. This term borrows the dignity of architecture, and is useful in a professional way. The writer much prefers the term Landscape Gardening; but it is apparent that the term landscape architecture is growing in favor with the profession, and there is little use in debating over a mere term. Properly speaking, the terms Landscape Gardening and landscape architecture are not synonymous, although in practice they are so used. It is not every place which is adapted to the making of a landscape picture. Formal gardens are often more to be desired than natural ones. They may conform to the principles of art, but it is the art of formal gardens, not of natural gardens. Too often have formal gardens been judged from the viewpoint of the natural or landscape garden, and hence confusion has arisen. There is now a slow but wholesome reaction against the too exclusive use of the true landscape garden. In practice, however, one cannot separate the two, so that one practitioner is, or should be, both landscape gardener and landscape architect. So it comes that the term landscape architecture stands for the whole art of laying out grounds. The term is therefore broader than its etymology would suggest: the word "architect" should be taken in its general sense of *contriver* or *planner*, rather than in its specific one of *builder*. It is the nature-like landscape garden, rather than the formalesque garden, which the writer has in mind in the advice which is given in this article. The character of the formalesque garden is dominated so completely by the nature of the architecture and the site, that condensed general remarks are of little purpose.

Landscape Gardening has undergone many fluctuations of taste within the century. Such changes are to be expected as long as the human race makes progress. The constantly increasing wealth of plants modifies the spirit of the work. It is no longer worth while to follow any school or cult. Every style has its use and place. In small city or suburban places, a formal or formalesque treatment of the ground plan may be desirable. In larger and freer places, the spirit of the fields may be given fuller expression The fundamental thing to consider is the fact that there must be a general theory or plan before there is any grading and planting,—these latter things are only means to an end. Yet many persons who would be called landscape gardeners conceive that to plant a place is the whole of the problem. The working out of the details of the plan is to Landscape Gardening what building is to architecture, or what pen-work and grammar are to literature. It is the industrial or constructional part of the work. It is what has been called Landscape Horticulture (Bailey "Garden and Forest," 1: 58). It has to do with all the details of kinds of plants, the care of them, the making of lawns, and similar problems. The American writings on Landscape Gardening are mostly writings on landscape horticulture and kinds of plants. Of indigenous American books, only two (Downing and Waugh) can be said to give a dominant share of their space to the principles of Landscape Gardening as a fine-art conception.

1229. An improvised ruin. 1728.

The first American practicing landscape gardener of note was André Parmentier, who came to this country from Belgium about 1824 and established a nursery on ground which is now in the heart of Brooklyn. He was a man of great taste and skill, and Andrew J. Downing considered his "labors and example as having effected, directly, far more for Landscape Gardening in America than those of any other individual whatever." He laid out many places, even as far away as the southern states on the south and Montreal on the north. The first American book on Landscape Gardening sprung full-fledged and complete from the pen of A. J. Downing in 1841, without having undergone the tedious evolution of preliminary and imperfect editions which characterize so many horticultural and kindred writings. It was immediately popular, and it has probably exerted a greater influence on American horticulture than any other single volume. It remains to this day without a superior and almost without a competitor. Downing was also the second prominent practicing landscape gardener, although his untimely death left the country with no completed works of his genius. His best known pieces are the grounds of the Smithsonian Institution and Lafayette Square, Washington, but it is doubtful if the subsequent treatment which the former demesne has received is such as would have pleased the designer. A. J. Downing's pomological work was continued by his painstaking brother Charles; but the artistic work dropped at his death, and Henry Winthrop Sargent, who edited the sixth edition of the "Landscape Gardening," in 1859, declared that "there has been no one since Mr. Downing's death who has exactly filled the niche he occupied in the public estimation." The third genius of American Landscape Gardening, and the one who has carried the art to its highest points of excellence, is Frederick Law Olmsted, who as a young man was inspired by Downing, and who became a landscape gardener when he was placed in charge of the improvements of Central Park, New York city, about 1856. For more than twenty-five years, Mr. Olmsted has given his talents wholly to this delightful art, and, more than any other American, has moulded and crystallized public taste respecting the appreciation of Landscape Gardening. A leading spirit in the construction of this great park was Calvert Vaux, who, with Olmsted, was joint author of the original plan. Vaux was also associated with A. J. Downing. He died in 1895. He was an excellent artist. The initiation of Central Park as a pleasure ground inaugurated the modern park systems of the country, and created what the Earl of Meath has recently designated the "veritable rage for park making" which has "seized the American public." See the article on *Parks*, Vol. III.

Within recent years, the number of practitioners of Landscape Gardening has greatly increased. The art is becoming established in popular estimation. Tastes may change, but the changes will affect only the minor applications of Landscape Gardening. The desire for artistic treatment of grounds is ineradicable. Three national societies are conservators of the Landscape Gardening and rural art of the country: American Park and Out-Door Art Association; American Society of Landscape Architects; Association of American Cemetery Superintendents.



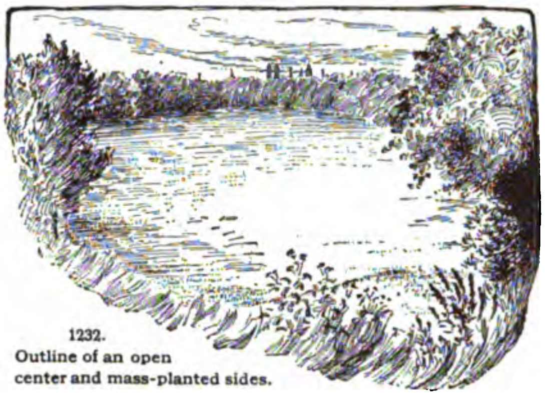
1230. Plan of the Leasowes, the seat of Shenstone. The residence is near the center.

The one point in which America excels other countries in landscape art is in the rural and garden cemetery. The first distinct movement towards a rural cemetery was made in 1825 by Jacob Bigelow, of Boston, whose work was soon taken up by the Massachusetts Horticultural Society. As a result of the agitation by this admirable organization, Mt. Auburn Cemetery, at Cambridge, was established and incorporated in 1831. The consummation of this enterprise gave to the world a cemetery which should be distinct from church-yards, removed from the city, and softened by the gracious touch of nature; and thereby, also, the young Massachusetts Horticultural Society set an example to all similar organizations and achieved for itself enduring fame. The work of Repton and Loudon had not then enlivened and broadened the conceptions of Landscape Gardening, and Mt. Auburn, whilst an excellent work of its kind, is not a landscape garden cemetery. The modern art of garden cemetery making—in which, as in the park, the continuous expanse of greensward is the fundamental conception of the fabric—originated with Adolph Strauch, who, in 1854, became superintendent of Spring Grove cemetery, Cincinnati. Strauch was a Prussian, born in 1822, and died in 1883. His work at Spring Grove cemetery has justly given him lasting fame, and his book describing the place must be consulted by any one who traces the evolution of the garden cemetery. The Board of Directors of the cemetery said, at the time of his death, that "he had filled the measure of his ambition by the consent of his profession, which ranked him as the equal of Repton and Pückler-Muskau as a master of art in landscape creation, which had been finally proved by him to be possible to be successfully applied in adorning and making attractive the last resting places of humanity." At the present time, about a hundred burial places in various parts of North America can be said to be landscape-garden cemeteries. See the article on *Landscape Cemeteries*, following.

The successful practice of Landscape Gardening depends, first, on an artistic temperament and an inherent love of nature; second, on an intimate knowledge of plants; and third, on familiarity with various arts and handicrafts, as the making of roads, grading, draining, enriching the land, and the like. Landscape Gardening must be sharply distinguished from gardening: the former is the making of pictures with plants; the latter is the growing of plants without reference to the picture. In one, the interest centers in art: in the other it centers in plants. Since Landscape Gardening is primarily a matter of taste, it is impossible that it be dominated by rules. However, a few general precepts and suggestions may be useful, and these are given in the following paragraph (see Figs. 1232–1238).

1231. Glimpse in Shenstone's Leasowes.

The motive of a true landscape garden, as already explained, is to make a picture. The picture should have a landscape or nature-like effect. The place should be one thing: it should emphasize some thought or feeling. It should have one central or emphatic object. Avoid scattered effects. Bunch or mass the planting. Distinguish sharply between the fundamentals and the incidentals,—those things which are to give the character or tone to the place, and those which are embellishments or ornaments. Keep one or more spaces open. Plant the sides or boundaries with masses. Use single or individual plants only to emphasize or to heighten an effect, not to give it character: they are incidentals. Ornament should be an incident. Foliage is a fundamental. Greensward is the canvas on which the picture is spread. Plants are more useful for the positions they occupy than for their kinds. Walks and drives are no part of a landscape picture: they are a necessity, but they may be made to conform to the spirit of the picture. The place for walks and drives is where they are needed: otherwise they have no use or purpose. It is the part of a good landscape gardener to make his grounds conform to the buildings: it should equally be the part of an architect to make his buildings conform to the landscape. Make views to desirable objects in the outlying landscape or the offscape. Obstruct the views to undesirable parts. Aim for a good prospect from every window in a residence, including the kitchen. Shear the trees and bushes when hedges, curiosities, and formal gardens are wanted: let them assume their natural forms when a landscape garden is wanted (Figs. 1237, 1238). Place no tree or plant until you are sure that it will mean something.


1232. Outline of an open center and mass-planted sides.

Suggestion from Englischer Garten, Munich.

The best results in the planning of any place are to be expected when one employs a competent landscape gardener. Avoid the man who places great stress on flower beds and "designs." Yet one can do much by himself, and be the happier for the effort. Books will help. Some of the current American books on Landscape Gardening and related topics are the following: Downing's "Landscape Gardening;" Kemp's "How to Lay Out a Garden;" Parson's "Landscape Gardening" and "How to Plan the Home Grounds;" Long's "Ornamental Gardening for Americans;" Waugh's "Landscape Gardening;" Maynard's "Landscape Gardening as Applied to Home Decoration;" Davis' "Ornamental Shrubs;" Van Rensselaer's "Art Out of Doors;" Bailey's "Garden-Making." See *Borders, Herbs, Lawns, Parks, Shrubs.*

L. H. B

Landscape Cemeteries (Plate XVII).—The cemeteries of the present day have come into existence from a desire to have burials made at a distance from centers of population, and among beautiful surroundings. They are often called "rural cemeteries." The first one in the United States to merit this name was Mt. Auburn, near Boston, Mass., founded in 1831. Since then the idea of having burial places park-like in their character has been spreading until they contain to-day some of the most beautiful landscapes developed by the hand of man. The wish to have in the cemetery all the beauty of trees, shrubs, lawns and flowers has gradually led to the abolition of fences, coping and other lot enclosures, and a reduction in the number of monuments and the size of headstones. There are many who now believe that the last resting place should be surrounded by the quietness and beauty of these features of nature's handiwork without distracting stonework or artificial objects. There are others who say that "the cemetery should be a cemetery," meaning by this expression that it should resemble somewhat closely the old churchyard or graveyard, with its multitude of crowded stones, inscribed with the names and good qualities of all buried within its walls.

All agree that the cemetery should be so situated and maintained as to menace in no way the healthfulness of surrounding neighborhoods. The ideal location is one where the ground is somewhat undulating and thoroughly drained by having a porous subsoil, while the surface soil is sufficiently rich and deep to support a good growth of vegetation. In some instances, as at Forest Hills, Boston, Mass., and at Woodlawn, New York, it has been necessary to blast and remove rock and then fill in the space with earth. In other cases, the natural soil has been so poor that it has been necessary to cover it with rich earth hauled from a long distance. In still other cases, it has been found necessary to select a clay soil because there was no other, or to make ground by excavating lakes, using the material excavated to raise the surrounding land, or to bury above ground in structures erected for the purpose, as at New Orleans.

When a site is chosen, it is usually subdivided into sections and lots, which must be made accessible by the construction of drives and walks. The drive should pass within 150 or 200 feet of every place available for burial. The width of the drive should vary according to the size of the cemetery and the probable amount of driving. If the area is very small, say not over four or five acres, it may be unnecessary to have any drive. In a little larger area, a grass drive 8 feet wide might suffice; in one still larger, a driveway 16 feet; and, finally, a cemetery designed to accommodate large populations should have good macadamized roadways 24 or 32 feet in width. Walks should generally be left in grass which forms part of a continuous lawn, such being better in appearance and more easily maintained than those made of gravel. The location of the drives will determine the shape and size of the sections. The plans should be made after a careful study of the ground in question, the drives being placed so that they will have easy grades, command good views, and ~~be as~~ few as possible without being more than 300 or 400 feet apart. When the ground is irregular in shape, or has steep slopes, or contains streams or lakes or valuable trees, these conditions may make it necessary to construct more drives than would otherwise be desirable. They can generally be staked out on the ground by eye with a better effect than if drawn first in an office by the use of some geometrical curve. They should nearly always be curved to produce the most pleasing result, a curved driveway being interesting because: (1) when the margins are properly planted certain portions of the ground are always hidden; (2) they insure varied effects of light and shade; (3) they make the average distance from the cemetery entrance to the lots shorter than if one follows straight lines and turns right angles.

1234. A flank planting, leaving the center free.

1233. A free and open center.

An open tract, to begin with, is in many ways preferable to one that is thickly wooded, but groups of trees or single specimens that have broadened out in a natural way would be very valuable, since they would help to take away the naked, forbidding appearance of land newly planted with young trees. On a vacant area, it is usually advisable to plant some large trees for the sake of immediate effect. These can be grouped about the entrance, a fork in the drives, the top of a hill, the margin of a lake, or other distinguishing position. The objection to a piece of land covered with thick woods is that the necessary thinning to get sufficient open space will leave tall, spindling trees, unused to exposure. These, while not very attractive in themselves, are very likely to die and are liable to be blown down. If there are thick woods in the land chosen, the trees selected to remain should be those that are healthiest and have the lowest branches. Some of the trees removed might be cut off at the ground, when the sprouts springing from the stump will form beautiful bush-like specimens.

The necessary buildings will vary with the size of the cemetery, but they should always be modest in appearance and suitably embellished with shrubbery and vines. The office would naturally be placed near the entrance to avoid unnecessary walking, but it should not be placed immediately on the highway or public street. The large arch frequently built over the gateway is usually too pretentious in appearance and not in keeping with the character of the grounds. A natural archway of living trees would be better. The chapel, if any, should be built well within the grounds to give it greater seclusion and quietness.

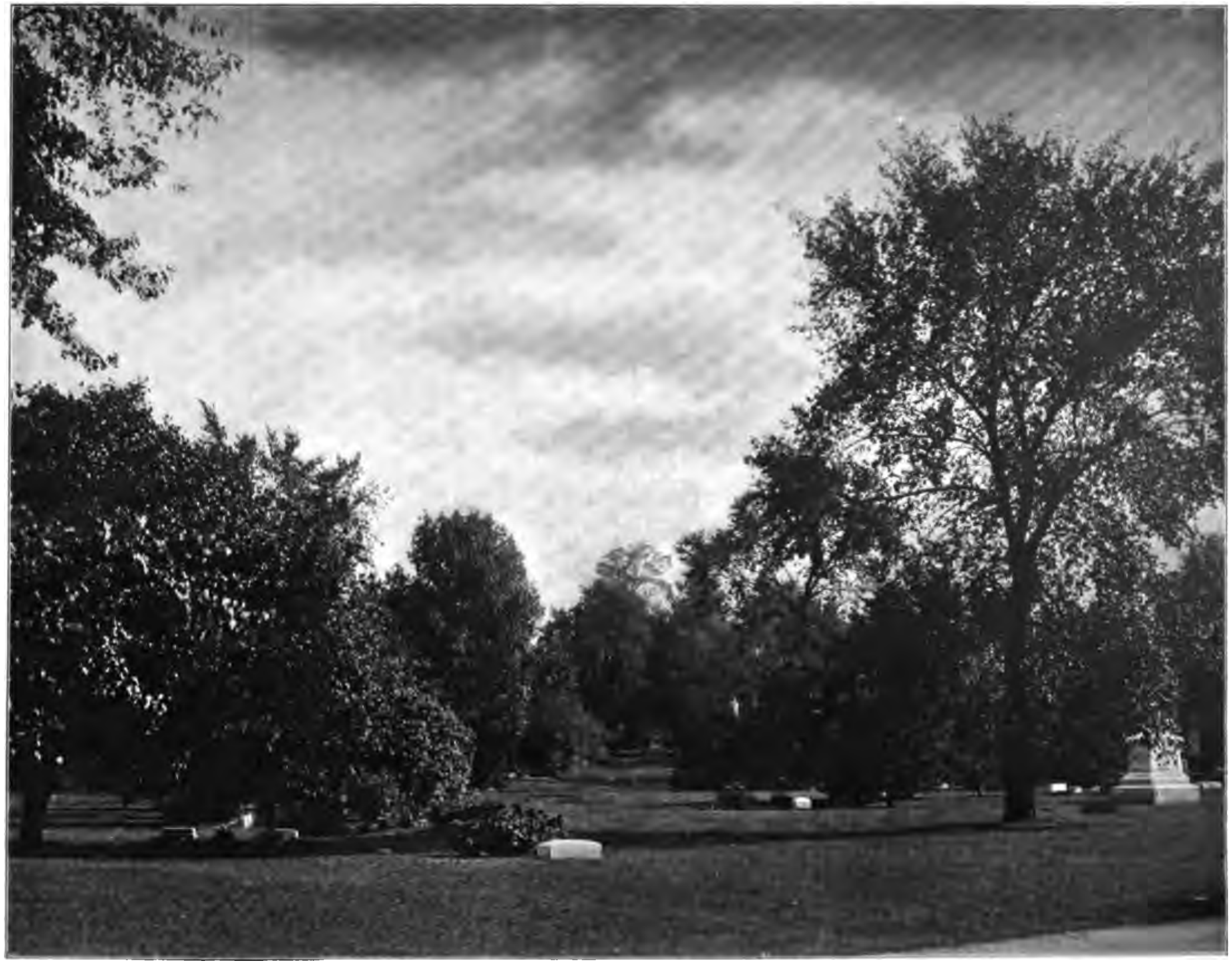
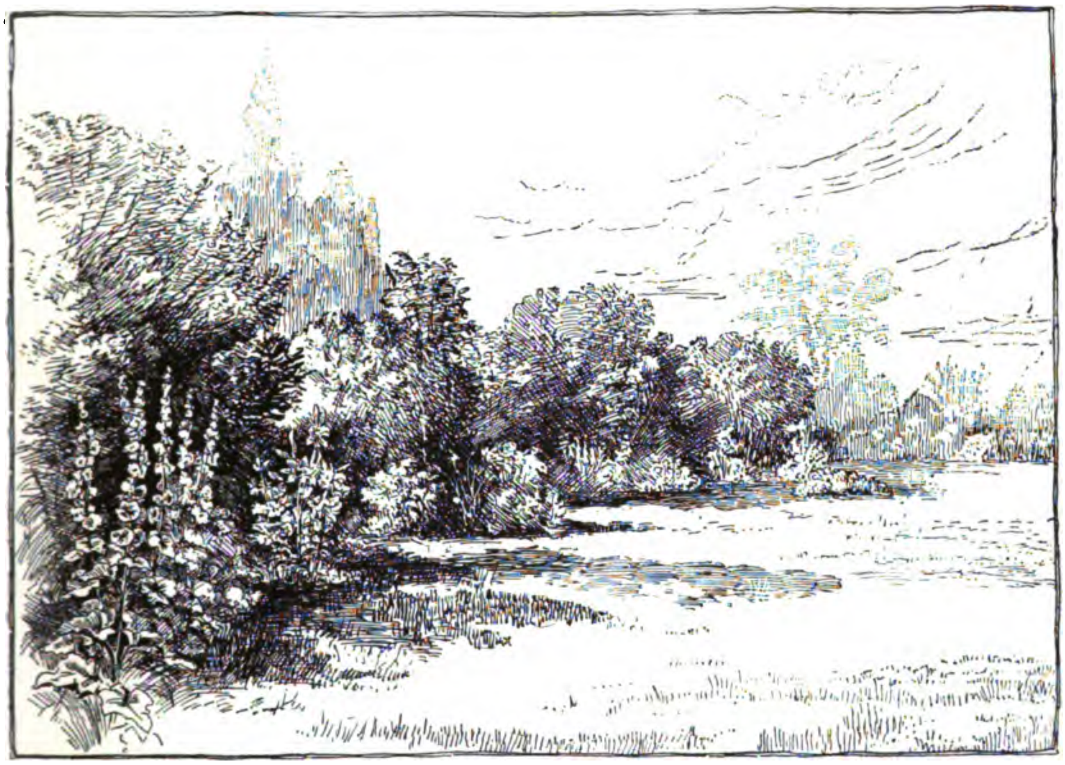


Plate XVII. A walk and vista in a Landscape Cemetery.—Graceland Cemetery, Chicago.

Whether there should be greenhouses or not cannot be discussed here on account of the limits of this article. It may simply be said that with the greater variety of flowering trees and shrubs which we have to choose from, as well as the thousands of hardy, flowering, herbaceous plants, most beautiful effects can be produced without the expense, the continual labor and the bare beds more than half the year, which would follow the construction of greenhouses. Usually the selection for planting of material found growing in the adjacent country will help to produce satisfactory results with little expenditure of money and time. To prevent intrusion, a fence along the boundary of the cemetery is necessary, but this can be a simple inexpensive wire fence, serving in places as a support for vines, and in places being hidden by a belt of trees and shrubbery. No one would now make the cemetery dreary by confining the planting to spruces and weeping willows. On the contrary, every effort is made to secure bright, cheerful effects by the selection of all kinds of flowering, happy-looking plants. The modern cemetery becomes in fact a sort of arboretum. It includes some evergreens which are most suitably grouped along the boundary belt, and which should contain all kinds of hardy pines, as well as the more stiff and formal spruces. The planting of Norway spruces has in many places been overdone. The development of attractive landscapes in cemeteries is of so much importance that Mr. Strauch, who was the greatest cemetery designer that we have had, used to call the present method "the landscape lawn plan."



1235. A structural foliage mass, with rugged sky line and irregular ground plan, and embellished with flowers on the margin.

A good landscape in the cemetery is usually the result of years of growth. It must first be carefully designed, and then receive care and attention from some one familiar and in sympathy with the scheme adopted. To insure such attention, and to protect the interest of all lot-owners, as well as to maintain the dignity and character of a city of the dead, rules have been adopted by all leading cemeteries. These rules are the result of study and experience on the part of many men. At a meeting of the Association of American Cemetery Superintendents, held at Boston, in 1890, the following rules were recommended by a unanimous vote of those in attendance:

Rule 1: (This should be a general rule, stating the authority and conditions on which lots are sold and the restrictions on transfers. The rule, of course, would have to be varied according to conditions existing in each cemetery.)

Rule 2: The Trustees desire to leave the improvements of lots, as far as possible, to the taste of the owners; but, in justice to all, they reserve the right, given them by law, to exclude or remove from any lot any headstone, monument or other structure, tree, plant or other object whatever which may conflict with the regulations, or which they shall consider injurious to the general appearance of the grounds; but no trees growing within any lot shall be removed or trimmed without the consent of the Trustees.

Rule 3: Lot-owners may have planting or other work done on their lots at their expense, upon application to the Superintendent. No workmen other than employees of the cemetery will be admitted to the cemetery except for the purpose of setting stone-work.

Rule 4: No iron- or wire-work, and no seats or vases will be allowed on lots, excepting by permission of the Trustees, and when any article made of iron begins to rust, the same shall be removed from the cemetery.

Rule 5: The Trustees desire to encourage the planting of trees and shrubbery, but, in order to protect the rights of all and to secure the best general results, they require that such planting shall be done only in accordance with the directions of the Superintendent of the cemetery.

Rule 6: No coping, nor any kind of enclosure, will be permitted. The boundaries of lots will be marked by corner-stones, which will be set by the cemetery, at the expense of the lot-owner, with the centers upon the lines bounding the lot. Corner-stones must not project above the ground and must not be altered nor removed.

Rule 7: No lots shall be filled above the established grade.

Rule 8: All interments in lots shall be restricted to the members of the family or relations of the lot-owner.

Rule 9: No disinterment will be allowed without the permission of the Trustees, of the lot-owner, and of the next of kin of the deceased.

1236. A good planting on the boundary. Against this background, flowers would look well.

Rule 10: Mounds over graves should be kept low, not exceeding four inches in height; and stone or other enclosures around graves will not be allowed.

Rule 11: Foundations for all monuments, headstones, etc., shall be built by the cemetery at the expense of the lot-owner, and fifteen days' notice must be given for the building of foundations. The cost of the same must be paid in advance.

Rule 12: Every foundation must be at least as wide and as long as the base stone resting upon it, and must not project above the surface of the ground. All foundations must extend as low as the bottom of the grave.

Rule 13: Only one monument will be permitted on a family burial lot.

Rule 14: (This should be a rule limiting the height of headstones, and the lower this limit is made the better. Even with the lawn is considered best.)

Rule 15: All stone- and marble-works, monuments and headstones must be accepted by the Superintendent as being in conformity with the foregoing rules before being taken into the cemetery.

Rule 16: No monument, headstone or coping, and no portion of any vault above ground, shall be constructed of other material than cut stone or real bronze. No artificial material will be permitted.

Rule 17: The Trustees wish, as far as possible, to discourage the building of vaults, believing, with the best landscape gardeners of the day, that they are generally injurious to the appearance of the grounds, and, unless constructed with great care, are apt to leak and are liable to rapid decay, and in the course of time to become unsightly ruins. Therefore, no vaults will be permitted to be built unless the designs for the same are exceptionally good, and the construction is solid and thorough. The designs must be submitted to the Trustees, and will not be approved unless the structure would, in their judgment, be an architectural ornament to the cemetery.

Rule 18: Material for stone or marble work will not be allowed to remain in the cemetery longer than shall be strictly necessary, and refuse or other unused material must be removed as soon as the work is completed. In case of neglect such removal will be made by the cemetery at the expense of the lot-owner and contractor, who shall be severally responsible. No material of any kind will be received at the cemetery after 12 o'clock M. on Saturdays.

Rule 19: The Trustees shall have the right to make exceptions from the foregoing rules in favor of designs which they consider exceptionally artistic and ornamental, and such exceptions shall not be construed as a rescission of any rule.

Rule 20: It shall be the duty and right of the Trustees from time to time to lay out and alter such avenues and walks, and to make such rules and regulations for the government of the grounds as they may deem requisite and proper and calculated to secure and promote the general object of the cemetery.

Rule 21: The Superintendent is directed to enforce the above regulations, and to exclude from the cemetery any person wilfully violating the same.

Cemeteries should be established upon a basis to enable those in authority to take uniform care of the grounds for all time. The prices charged for lots should be high enough to enable a fund to be set aside that will yield an annual income sufficient to pay all necessary general expenses. In laying out a new cemetery, those in charge should seek the best advice available. Such advice should be based on a thorough knowledge of Landscape Gardening and the special needs of burial grounds. Much information can be obtained by visiting Spring Grove, at Cincinnati, Ohio, generally recognized as the pioneer of park-like cemeteries, and perhaps the best example in the world. Oakwoods Cemetery, at Troy, N. Y.; Swan Point Cemetery, at Providence, R. I., and Forest Hills, at Boston, Mass., are some of the prominent examples of the system now in vogue. Graceland Cemetery, at Chicago, Ill., although much smaller in area than those already mentioned, contains some good landscape effects. There are many other cemeteries in the vicinity of the large cities of the United States which can be commended on account of the good taste displayed in them. There are others, like Mt. Auburn of Boston, Greenwood of Brooklyn and Laurel Hill of Philadelphia, which, while containing many beautiful trees and expensive monuments, include also many fences, railings, copings and hedges that serve as examples of what to avoid rather than to imitate.

Our leading cemeteries should keep pace with the best thought of the times, with the best theories of religion, science and economics. They should be, as the name implies, sleeping places—places of rest and freedom from intrusion. It seems natural that people should select for such a place the very best production of landscape-art, a place where spreading lawns give a cheerful warmth and sunlight; where pleasing vistas show distant clouds or the setting sun; where branching trees give grateful shade, furnish pleasing objects to look at, and places for the birds to come each year and sing

1237. An artistic group-planting alongside a walk.

again their welcome songs; where blossoming shrubs delight the eye, perfume the air, and make attractive resting places. Such places may seem to exist more for the living than for the dead, but the living are the ones that need them. If it seems natural to select a most beautiful park, a real picture, we might say, for a sleeping place, it seems strange to put into this picture obelisk after obelisk, stone posts and slabs of all shapes and sizes, and stone tombs within whose walls their owners hope to have their dead bodies preserved forever. The history of sepulture shows the futility of trying to preserve one's body or one's name with the help of stone. A man can only hand his name down to posterity by his own work, and even if his body should be preserved as long as were those of the ancient Egyptians, it might finally be used only to propel a locomotive or a steamboat. These facts should be recognized in the modern cemetery. The ground should assist in changing the body back into organic forms or to receive the ashes, if the quicker process of cremation is adopted. The scenery should solace those that are bereft.

1238. A group which has been spoiled by the pruning shears.

It is repugnant to our best feelings to use the same land over and over again, as is done in many cities in Europe and, to some extent, in the United States. A cemetery is frequently spoken of as the last resting place, and it serves mankind best when it is so in fact, since in that case, after it has served its purpose of purification, it becomes a park, a breathing place for the people of the city, whose growth is likely to crowd the vicinity with houses. The memory of past generations will certainly be sweeter if it is associated with trees, than if it is connected with tombs, catacombs and pyramids. The problem presented to cemetery associations is, therefore, how to secure the most pleasing combinations of growing plants, including trees, shrubs, flowers and grass; the most satisfactory views; the most harmonious and restful park, for the cemetery is really a memorial park.

Those seeking information on this subject will find it in the histories of the various cemeteries and in encyclopædias. The development of the landscape idea in connection with cemeteries is given in some of the reports of those institutions, that of Spring Grove for the year 1869 being especially valuable. The reports of the Association of American Cemetery Superintendents contain many papers of interest. The volumes of the "Modern Cemetery," afterwards the "Park and Cemetery," the only periodical devoted to the interests of burial places, contain articles relating to all phases of the subject. All books relating in any way to Landscape Gardening are of value in cemetery work, since they treat of all its natural features.

O. C. SIMONDS.

LANTÀNA (old name, once applied to a Viburnum). *Verbenàceæ*. Perhaps a half hundred species of herbs or shrubs, sometimes half-climbing, with opposite rough dentate leaves, and spikes or cymes of small verbena-like flowers. They are natives of the tropical and subtropical parts of Asia, Africa and America. Fls. small, gamopetalous, the calyx very small, the corolla somewhat irregularly 4–5-parted, the corolla tube slender: stamens 4, didynamous: ovary 2-loculed, becoming a fleshy or dryish drupe with 2 nutlets. The bracts subtending the head often imitate an involucre. Verbena differs in having akene-like nutlets and long-tubular 5-toothed calyx.

Lantanas have been long in cultivation, and it is difficult to refer the garden forms to botanical species. The species themselves are confusing. Most of the garden kinds are of the *L. Camara* type. There are several Camara-like species which probably have hybridized to produce these forms; but Voss, the latest garden monographer, regards these species as only forms of *L. Camara* (preferring, however, to use the name *L. aculeata*). Accepting *L. Camara* in Voss's sense, the garden Lantanas may be said to be derived from that species; and this view is adopted below. Monogr. by J. C. Schauer, DC. Prodr. xi. 594–609.

L. H. B.

The Lantana has been improved in its usefulness as a bedding plant of late years, largely through the efforts of French hybridizers. The older varieties were mostly rather tall and lanky, later in coming into bloom, and dropped their flowers badly after rain storms, but were showy in warm and dry weather. The new varieties are dwarf, spreading and bushy in habit, early and free-flowering, and the heads or umbels of bloom average much larger, with florets in proportion; nor do they drop off from the plants as the old varieties did in bad weather. These newer kinds are not as well known as they should be. They are very desirable for any situation where sun-loving bedding plants are used, in groups or borders, window-boxes, baskets and vases. The Lantana is not particular as to soil, and flourishes provided the exposure is sunny and the soil well supplied with moisture, at least until a fair growth has been made. When well established it does not seem to mind drought, and continue bright and attractive in the hottest weather. It should not be transplanted out in the open before danger of frost is over. If the old plants are wanted for propagation, cut them back and transfer to pots early in September, and when they start into new growth the soft wood will furnish cuttings that root easily. Keep young stock in a warm position through the winter months, and repot in April.

Save the old plants, after Jack Frost has nipped their freshness late in the fall, prune severely back, remove them indoors, giving them a temperature anywhere above 40°, and with a little attention and fresh soil, every plant will be a perfect specimen, covered with bloom in May. Gardeners train them into fine standards, as prim and shapely as need be. Among the French varieties the most representative are Argus, orange with yellow center; Tethys, canary yellow; A. Claveau, silvery rose with yellow center. These are very dwarf spreading growers, about 8 in. high. Amiel is semi-dwarf, orange-red with yellow center, bright and showy; Protée belongs to the same class, rose color, yellow-shaded center; Delicatissima is a trailing or creeping sort, with slender stems, small leaves and dainty flowers of pink and lavender: La Pluie d'Or, golden yellow, is a standard variety among the older kinds.

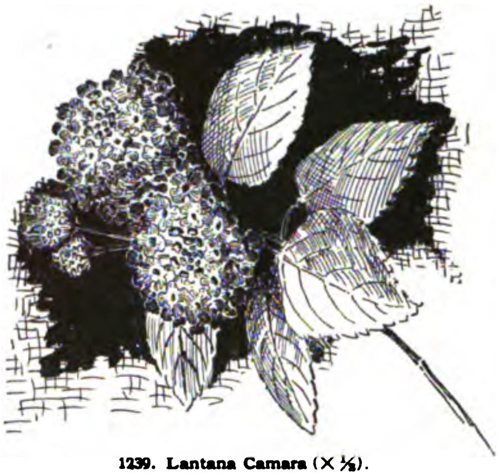
GROVE P. RAWSON.

A. *Plant often spiny: fruit juicy.*

Camàra, Linn. (*L. aculeàta*, Linn.). Fig. 1239. Small shrub, 1–4 ft. high, hairy, sometimes with short, hooked prickles: lvs. rather thick, rugose, scabrous above but pubescent beneath, ovate or cordate-ovate, mostly short-acuminate, crenate-dentate, the petioles short: clusters of fls. on strong axillary peduncles which may or may not exceed the lvs.: fls. in a dense, nearly flat-topped head, usually opening yellow or pink but changing to orange or scarlet, the bracts narrow and not conspicuous. Trop. Amer., extending north to Texas and S. Ga. B.M. 96. L.B.C. 12:1171 (as *L. scabrida*, Ait.).—In the wild, the plant may grow 10 ft. high, and it is usually prickly (hence the name *L. aculeata* of Linnæus). The cultivated plant is less prickly or even unarmed. The plant has a strong smell, but the ease with which it can be made to produce an almost continuous supply of bloom renders it a popular greenhouse and bedding subject. Color of fls. varies on different plants. Of late years the Lantanas have been neglected by florists, but improved varieties are now bringing it into favor again.

Var. **nivea** (*L. nivea*, Vent.). Fls. white, the outer ones becoming bluish: heads rounder. B.M. 1946.

Var. **mutábilis** (*L. nívea*, var. *mutábilis*, Hook.). Remarkable for the change of color in the nearly globular heads: in little more than a day the fls. may change from white through yellowish, lilac, rose and blue. The outer fls. open white and run through yellowish, rose and lilac; the inner ones open yellowish. B.M. 3110. R.H. 1852:461.



1239. Lantana Camara (X ⅓).

Var. **místa** (*L. místa*, Linn. Not spelled *mixta* by Linnæus, although it is so spelled by later authors). Outer fls. opening yellowish and becoming saffron and brick-red; inner fls. yellow, changing to orange.

Var. **cròcea** (*L. cròcea*, Jacq.). Fls. opening sulfur-yellow and changing to saffron. R.H. 1852:461.

Var. **sanguínea** (*L. sanguínea*, Medic.). Fls. opening saffron-yellow, changing to bright red.

purpùrea, Hornem. Erect: branches 4-angled and somewhat hairy, with few recurved spines: lvs. ovate, narrowed into a petiole, acuminate, serrate-crenate, rugose: fls. purple, very pretty, in hemispherical-umbellate heads, the bracts short and lance-subulate. S. Amer. —Int. by Franceschi, 1900. A form of *L. Camara ?*

AA. *Plant never spiny: fruit thin-fleshed, usually not juicy.*

trifòlia, Linn. (*L. ánnua*, Linn.). Half-shrubby, hairy: lvs. ovate-lanceolate or elliptic-oblong, pointed, crenate-dentate, in 3's or 4's: heads becoming ovoid or oblong, the involucre not conspicuous: fls. rose-lilac varying to white, with yellow throat: fr. rather pulpy, showing well amongst the bracts. Trop. Amer. B.M. 1449.—The name *L. annua* seems to have been applied to young plants, on the impression that they were annuals. The picture of *L. annua* in B.M. 1022 is quite as likely to be a form of *L. Camara*. Little known in cult.

Sellowiàna, Link and Otto (*L. delicatíssima*, Hort.?). Weeping or Trailing Lantana. Twiggy, slender plant with lopping or trailing pubescent branches: lvs. small, ovate, tapering below, close-toothed: fls. small, in long-stalked small heads, rosy lilac, the outer bracts or scales of the involucre broad-ovate and hairy and half or less as long as the slender pubescent corolla tube. S. Amer. B.M. 2981. B. 3:115. R.H. 1852:461?—A very profuse bloomer in both winter and summer, and most desirable for pot or basket culture. Should be better known. Verbena-like. The plant seems to be an escape in Fla.

involucràta, Linn. Low, much-branched bush, with obscurely 4-angled gray branches, and blunt, ovate, small, crenate-dentate lvs.: fls. small, nearly or quite equalled by the ovate involucre bracts. Trop. Amer., reaching N. to S. Fla. and S. Tex.—Said to be occasionally cult. indoors for the light lilac or white fls.

L. H. B.

LAPAGÈRIA (the Empress Josephine, *née* Tascher de La Pagerie). *Liliàceæ.* Chilean Bellflower. A single species of noble, half-hardy evergreen climber, allied to the smilaxes. Lvs. alternate, lance-ovate or cordate-lanceolate, 3–5-nerved, acuminate: fls. large and showy, bell-shaped, hanging singly from the upper axils or somewhat racemose at the end of the vine, about 3 in. long; stamens 6, borne on the torus or slightly attached to the base of the inner segments, shorter than the perianth: ovary sessile and 1-loculed, with 3 parietal placentæ, ripening into a 3-angled, oblong, fleshy, indehiscent, berry-like beaked fruit, and bearing nearly globular seeds imbedded in the pulp. **L. ròsea**, Ruiz & Pavon, is the only species. Fig. 1240. It has rose-colored or rose-crimson fls., with lighter spots. Chile. B.M. 4447. F.S. 5:491; 20:2059–60. R.H. 1850:101. Gt. 46:1445; 47, p. 101. G.C. III. 20:657 (fruits); 25:45. Gn. 34, p. 321; 48, p. 475; 49:1056; 55, p. 57. Gng. 5:356. Mn. 7:191. Var. **albiflòra**, Hook. (var. *álba*, Hort.), has white or whitish fls. B.M. 4892. R.H. 1852:441. F.S. 20:2059–60. Gn. 41, p. 53; 49:1056 and p. 175; 54, p. 277. A.G. 13:745 (poor). Gng. 2.187; 5:356. A double-fld. form of the white variety is shown in G.C. II. 17:777. The species is variable in vigor, floriferousness, size, color and substance of bloom, and there are a number of named horticultural subvarieties. Lapagerias are tall-twining plants, suitable for rafters or walls in coolhouses, or for culture in the open in the milder parts of the country. They are usually propagated from layers, but stronger plants usually are obtained from seeds, although varieties may not come true. The first live plants were introduced into England in 1847. Lapagerias should be seen more frequently in America. Franceschi says that in California the plant prefers shady places "where the atmosphere will never become too dry."

Lapageria rosea and *Philesia buxifolia* have been hybridized by Veitch, producing a plant known as *Philageria Veitchii*, Mast. (G.C. 1872:358). Philesia afforded the pollen. It is not in the American trade, but is a most interesting plant hybrid. For an anatomical study of it, bearing on problems of hybridity, see J. M. Macfarlane, Trans. Roy. Soc. Edinburgh, 37, pt. 1, p. 207 (1892).

L. H. B.

It is by no means an easy task to grow Lapagerias. They do best planted out into a cool greenhouse, where only the morning sun strikes them. If the border or bed in the greenhouse is on a naturally sandy or gravelly subsoil, so that the natural drainage is perfect, it is an ideal place for these plants. They like a deep bed of sand or gravel underneath their roots, where abundance of water can be applied during the spring and summer months and where the drainage is perfect. Light peaty loam is best, and after plants are fully established they like plenty of liquid fertilizing. The soil, in all cases,

1240. Lapageria rosea (X ⅓).

must be open and sandy. They should be trained against a wall, facing either the east or north. Abundant syringing, temperature not to exceed 50° to 60° at night, and even as low as 45° at night in winter, plenty of air,—these are requisites. In winter they require but little water except spraying when the temperature warrants it. Where no such sandy strata or subsoil exists it must be provided, but care must be taken that they are not crowded into an obscure corner where the soil will not dry out, as otherwise it will sour and the plants not do well. The roots must not be put too deep, as the plant is a shallow rooter. If no sand-bed can be had it is best to have the young plants in shallow pans, and, breaking the bottom, set them into such a prepared bed, sinking the pans until the roots go out into the prepared bed. In their native homes Lapagerias grow where plenty of water falls during their growing season and where they are semi-dormant the rest of the year. They flower from the well-ripened and matured wood of a strong growth. Propagation is effected by by means of layers or from seeds. H. A. SIEBRECHT.

LAPEIROÙSIA. Preferably spelled *Lapeyrousia*.

LAPEYROÙSIA (Jean François Galoup de Lapeyrouse, distinguished French naval officer, born 1741). *Iridàceæ.* About 32 species of African bulbs, something like Freesias, but with blue or red fls., which are produced in summer instead of spring. They can be grown outdoors in the North with some winter covering, and are said to be quite hardy south of Washington, D. C., if planted deep. By American dealers they are still listed under the name of Anomatheca, which Baker has reduced to one of the 3 subgenera of Lapeyrousia, characterized by having several lvs. forming a 2-ranked basal rosette, accompanied by a long, branched stem. Lapeyrousia is further distinguished from Freesia by having a more slender perianth-tube, with the stamens inserted at the throat instead of below; also by the ovules being more regularly superposed instead of crowded together. The species of Lapeyrousia have an egg-shaped or globose corm about ½ in. thick, and matted with tunics: lvs. linear or sword-shaped: inflorescence various, often a loose, 1-sided, more or less zigzag spike, as in Freesia: fls. variously colored, 1–2 in. across; perianth tube long or short; segments spreading, 3 larger than the other 3. Monographed by Baker in his "Hand book of the Irideæ," and also in the African floras.

These plants will probably never have anything like the degree of popularity enjoyed by Freesias, because of their later season of bloom and lack of fragrance. Probably the most popular kind is *L. cruenta*, which grows 6–10 in. high, blooming in summer and fall. In a sheltered and in light, porous soil it generally succeeds in the North without any protection, but the bulbs are safer in very severe winters under a covering of litter or straw. The bulbs increase rapidly, and should be divided every few years before they become too crowded.

A. *Color of fls. chiefly blue or violet.*

corymbòsa, Ker. (*Anomathèca corymbòsa*, Hort. A. Blanc). This belongs to the subgenus Ovieda, having usually 1–2 basal lvs., while the next 3 species belong to the subgenus Anomatheca, having more numerous lvs. *L. corymbosa* has 1 basal leaf which is spreading, sword-shaped, 4–6 in. long: inflorescence a dense flat-topped cluster of as many as 15 fls. each about 1 in. across, with practically regular segments, blue, with a star-shaped white figure near the throat, outlined in black after the fashion of Quedlinburg Phlox. B.M. 595. J.H. III. 32:379.

AA. *Color of fls. red, with 3 darker spots at the base of the 3 smaller segments.*

B. *Size of fls. 2 in. across.*

grandiflòra, Baker. (*A. grandiflòra*, Baker). Lvs. 1 ft. or more long: fls. bright red; stamens as long as the segments; the 3 style branches each 2-cut. B.M. 6924. —A newer species than cruenta, and perhaps destined to greater favor. Corm globose (ovoid in the others here described).

BB. *Size of fls. 1 in. across.*

C. *Segments bright carmine.*

cruénta, Benth. (*A. cruénta*, Lindl.). Lvs. ½–1 ft. long: stamens less than half as long as the segments: the 3 style branches uncut. B.R. 16:1369. L.B.C. 19:1857. P.M. 1:103. J.H. III. 31:397.

CC. *Segments pale red or rosy.*

júncea, Pourr. (*A. júncea*, Ker.). Lvs. strap-shaped, (linear in the 2 preceding species), 6–8 in. long: stamens half as long as the segments.—Less known in cult. than the others. J. B. KELLER and W. M.

LAPPA. See *Arctium*.

LARCH. See *Larix*.

LARDIZABÀLA (after the Spanish naturalist Lardizabal y Uribe). *Berberidàceæ.* Six species of S. American shrubby climbers, mostly Chilean, one of which is cult. outdoors in S. Calif. and the warmer parts of Europe. It is something like the well known hardy vine *Akebia quinata*, having similar, odd-looking, dark-colored fls., but the leaflets are in 3's instead of 5's. The leaves may be once, twice or thrice ternate, and they are dark green, glossy, and here and there have 1 or 2 almost spiny teeth.

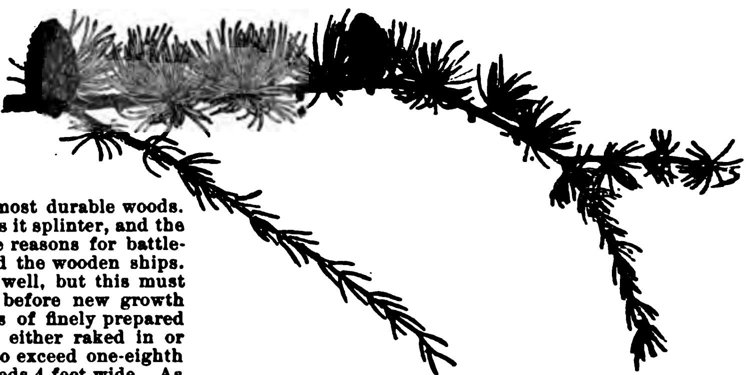
There are 4 genera of the Barberry family containing shrubby climbers that are cult. Of these Akebia is the best. Akebia and Holbœllia have free stamens: Lardizabala and Stauntonia have monadelphous stamens. In all of these the showy parts are the 6 sepals, the 6 petals being much smaller in Lardizabala and absent in Stauntonia. Lardizabala is further distinguished from Stauntonia by having once- to thrice-ternate foliage and oblong berries, while Stauntonia has digitate foliage with 3–7 leaflets.

biternàta, Ruiz & Pav. Lvs. generally once ternate, particularly in the flowering branches: lfts. rather leathery, evergreen, ovate, dark green above, paler and netted-veined beneath: staminate fls. in a dense drooping spike, containing as many as 15 fls. each about 1 in. across, with ovate dark purplish chocolate colored sepals and small lanceolate white petals. Chile. B.M. 4501. Gn. 28, p. 489.—Grows about 12 ft. high against walls in warmer parts of England. The fruit is said to be sold in the Chilean markets and cordage is made of the fiber. W. M.

LÀRIX (ancient Latin name). *Coniferæ.* LARCH. TAMARACK. Ornamental deciduous coniferous trees of pyramidal habit, with the lvs. linear and clustered except on young shoots, where they are spirally arranged, and with the pistillate fls. often very conspicuous by their bright purple color: cones erect, globose to oblong, rarely more than 2 in. long. They are all hardy North except the Himalayan *L. Griffithi*, and are often planted as park trees, chiefly for the light green foliage and the regular conical, or in some vars. pendulous, habit. The most beautiful is probably *L. leptolepis*, with the foliage turning bright yellow in fall, while the others assume only a pale yellow color. They are also very valuable forest trees, especially for the northern and mountainous regions; no forest tree goes farther north than the Larch, reaching in N. America 67° and in Siberia 72° of latitude. The wood is hard, heavy and very durable, and much used for construction, that of *L. occidentalis* being considered the best of all American conifers. From the European Larch turpentine is obtained. The bark contains tannin, and an extract is used for tanning leather. The Larch grows in almost any kind of soil, including clay and limestone, and prefers a somewhat moist, but well-drained soil and an open situation; the American Larch grows well even in swamps. Unfortunately several insects and fungi prey on the Larch, and sometimes do considerable damage, especially the leaf-eating larvæ of some moths. Prop. usually by seeds sown in spring, and the young seedlings shaded; vars. are grafted on seedlings, mostly on those of *L. decidua* (*Europæa*), either outdoors by whip- or cleft-grafting or in the greenhouse by veneer-grafting; they may also be increased by cuttings of nearly ripened wood under glass or by layers, but this method is rarely

practiced. Nine species in the colder regions of the northern hemisphere. Staminate fls. small, globose to oblong, solitary, consisting of numerous short-stalked, spirally arranged anthers; pistillate fls. larger, consisting of several or numerous scales, with 2 naked ovules at the base, each scale borne in the axil of a much longer bract; cone with woody, 2-seeded scales, persistent on the axis; seeds with large, thin wings, ripening the first year.
ALFRED REHDER.

The European Larch is an upright, conical grower, and one of our best lawn trees. In the spring, when it is covered with its new growth of soft, feathery, light green foliage, it is a very striking and beautiful object. As it begins growth at a low temperature, it is the first of our trees to be covered with new foliage. Again in the autumn it is very beautiful, as its needles turn a golden color before falling, for this tree, unlike most of the conifers, is deciduous after the first year. In the middle West and along the coast in Massachusetts, it is planted for timber, shelter belts and wind-breaks. Unlike its American relative, *L. Americana*, or Tamarack, this tree grows on high ground and does well on a great variety of soils. It does not do well on low, submerged ground, the home of *L. Americana*. The Larch is known in Europe as one of the most durable woods. It does not ignite easily, neither does it splinter, and the wood was in great demand for these reasons for battleships before the ironclads displaced the wooden ships.


1241. Larix decidua (× ½).
Commonly known as *L. Europæa*.

The Larch stands transplanting well, but this must be done very early in the spring, before new growth begins. The seed is sown in beds of finely prepared soil, about the middle of May, and either raked in or covered very lightly by hand, not to exceed one-eighth of an inch. It is usually sown in beds 4 feet wide. As soon as it germinates it is shaded with lath frames, raised about 10 inches above the bed. The first year it makes a growth of from 2 to 4 inches, and holds its foliage the first winter. A slight covering of hay or straw should be lightly shaken over the seedlings as soon as winter sets in, to prevent the seedlings being thrown out by continual freezing and thawing. The frames are put on again to hold the snow. During the following summer the frames should be removed entirely. At two years old they will be from 6 to 20 inches in height, and can then be moved to nursery rows or planted out permanently in the forest. The seeds should be sown thicker than other conifer seed, as seldom over 60 per cent germinate. Sometimes they make very little upward growth the first and second years after transplanting, seemingly putting all their strength into the side shoots in order to spread out and shade the ground over their roots, a custom followed by all the conifers on hot, sandy soil. This being finally accomplished, they will make a rapid upward growth.
THOS. H. DOUGLAS.

A. *Bracts longer than the scales: scales numerous, stiff, spreading or recurved after maturity.*

occidentàlis, Nutt. Tall tree, to 150 ft., with dark-colored bark, becoming bright cinnamon-red on older trunks, and with short, horizontal branches, forming a narrow pyramidal head: branchlets pubescent when young: lvs. rigid, sharply pointed, triangular, keeled beneath, 1-1¾ in. long, pale green: cone oblong, 1-1½ in. long: scales orbicular, almost entire, tomentose beneath. Brit. Col. to Mont. and Ore. S.S. 12:594. G.F. 9:497. Gt. 20:685, figs. 8-10. G.C. II. 25:652. B.H. 22:8, figs. 3-5.

AA. *Bracts shorter than scales.*

B. *Lvs. with 2 white lines beneath: scales numerous, reflexed at the apex.*

leptólepis, Murr. (*L. Kǽmpferi*, Sarg., not Gord.). Tree, to 80 ft., with horizontal branches, forming a pyramidal head: branchlet yellowish or reddish brown, glabrous and glossy; spurs short and globular: lvs. rather broad, obtuse, soft, ½-1½ in., light or bluish green: cones ovate-oblong, ½-1½ in. long, with emarginate, roundish ovate scales. Jap. G.C. II. 19:88. Gt. 20:685, fig. 5. B.H. 22:8, fig. 2.—The handsomest of the Larches as a lawn tree. Var. **minor**, Murr. (var. *Murrayàna*, Maxim. *L. Japónica*, Murr., not Carr.). Dwarfer form with smaller cones. Gt. 20:685, fig. 2. B. H. 22:9, fig. 4.

BB. *Lvs. without white lines, very narrow: scales erect-spreading, straight or slightly incurved at the apex.*

decídua, Mill. (*L. Europæa*, DC.). EUROPEAN LARCH. Fig. 1241. Tree, to 100 ft., with pyramidal, later often irregular, head: bark dark grayish brown: branchlets slender, glabrous, yellowish: lvs. compressed, triangular, soft and obtuse, bright green, ¾-1¼ in. long: pistillate fls. purplish; cones ¾-1½ in. long, with many almost orbicular scales, usually finely tomentose on the back. N. and M. Eu. Gt. 20:684, fig. 3. B.H. 22:7, fig. 1. Var. **péndula**, Loud. With pendulous branches; sometimes confounded with the American Larch. Gt. 20:684, fig. 11. B.H. 22:8, fig. 1. Gn. 35, p. 245 and 39, p. 84.

Americàna, Michx. (*L. microcárpa*, Desf. *L. péndula*, Salisb. *L. laricìna*, Koch). TAMARACK. HACKMATACK. Tree, to 60 ft., with horizontal branches, forming a narrow pyramidal head, sometimes broad and open on older trees; bark reddish brown: branchlets slender, glabrous, often bloomy: lvs. like those of the former, but of light bluish green: cones small, oval or almost globular, ½-¾ in. long; scales few to 20, almost orbicular and entire, glabrous. Canada, south to Pa., west to Ill. and Manitoba. S.S. 12:593. Em. 106. Gt. 20:684, fig. 7-8. B.H. 22:10, fig. 2-3.

L. Dahùrica, Turcz. Similar to L. Americana. Tree, to 70 ft., sometimes procumbent: cone usually with more than 20 scales, more spreading at maturity. Amurland, Sachalin. Gt. 20:684, figs. 9-10. B.H. 22:9, figs. 5-6.—*L. Chinénsis*, Beissn. Tree, with glabrous branchlets: lvs. with 2 white lines beneath: cones similar to those of L. occidentalis. China.—*L. Griffithi*, Hook. f. & Thoms. Pyramidal tree, to 60 ft., with spreading and pendulous branches: lvs. soft, obtuse: cones 2-3 in. long, oblong, with exserted and reflexed bracts. Himal. F.S. 12:1267-68. R.H. 1868, p. 371. Gt. 20:685, figs. 1-4. B.H. 22:10, figs. 4-7. G.C. II. 25:719; 26:465.—*L. Kæmpferi*, Gord. = Pseudolarix Kæmpferi.—*L. Kæmpferi*, Sarg. = L. leptolepis.—*L. Kurilénsis*, Mayr (L. Dahurica Japonica, Maxim.). Allied to L. leptolepis, to 70 ft.: young branchlets deep bluish red, puberulous: lvs. rigid: bracts as long or somewhat shorter than scales. N. Jap.—*L. Lyalli*, Parl. Allied to L. occidentalis, but less high: young branchlets tomentose: lvs. quadrangular: young cones deep purple, the scales with fringed margin. Brit. Col. to Wash. S.S. 12:595. G.C. II. 25:653; III. 23:357. Gt. 20:685, figs. 11-13. B.H. 22:9, figs. 1-3.—*L. Sibírica*, Ledeb. (L. Europæa Sibirica and var. Rossica, Regel). Allied to L. decidua. Pyramidal tree, to 90 ft., with ascending branches: lvs. longer: pistillate fls. usually green, sometimes brown: cones larger, with fewer but larger scales. Siberia. Gt. 20:684, figs. 1-2. B.H. 22:7, figs. 2-3.
ALFRED REHDER.

LARKSPUR. Species of *Delphinium*.

LASIAGRÓSTIS. See *Stipa*.

LASIÁNDRA. See *Tibouchina*.

LASTHÈNIA (name of a woman who was a pupil of Plato). *Compósitæ.* Low, slender annuals with numerous inch-wide yellow flowers in early summer.

glabràta, Lindl. (*L. Califórnica,* Lindl. *Homológyne glabràta,* Bartl.). The plant cult. under this name is likely to be *Baeria gracilis,* which see. Height 1 ft.: lvs. much longer than in *B. gracilis,* strongly keeled, not hairy, or rarely pubescent: involucre enlarged below the flower. Calif. B.M. 3730. B.R. 21:1780 & 1823.

LASTRÈA (C. J. L. Delastre, Austrian botanist). A name commonly used in England for species of Dryopteris. Also spelled *Lastræa.* On the basis of priority it has no claim to recognition, as it was established by Bory, in 1824, while we have Nephrodium, 1803; Aspidium, 1801; Tectaria, 1800; Polystichum, 1799, and Dryopteris, 1763.

The following additional species of Dryopteris (Vol. I. p. 508) are in the American trade under the name Lastrea (the combinations are for Dryopteris, not Lastrea):

A. *Lowest pinnæ reduced to auricles: texture thin.*

sáncta, Kuntze. Lvs. 6–9 in. long, 1–2 in. wide on short slender stems; lower pinnæ very much reduced; under surface glandular. West Indies.

palústris, Kuntze. Lvs. 2–3 ft. long, 8–12 in. wide, on long straw-colored stems; lower pinnæ reduced, the upper ¾ in. wide, cut down to the rachis into linear-oblong lobes. Brazil.

montàna, Kuntze. Lvs. 1½–2 ft. long, 6–8 in. wide; lower pinnæ greatly reduced to mere auricles; upper pinnæ 1 in. wide, cut into close blunt lobes. Eu., western N. America. A variety *cristàto-grácile* is also cult.

AA. *Lower pinnæ scarcely reduced: texture firm.*

rígida, Kuntze. Stipes stout, densely scaly: lvs. 1–1½ ft. long, 4–6 in. wide, oblong-lanceolate, the lower pinnæ not reduced; segments with mucronate teeth. Eu. Var. **argùta** in Calif.

lépida, Moore. Lvs. 1½ ft. long, 6–7 in. wide, ovate, bipinnatifid or bipinnate, the lower 4 or 5 pairs slightly smaller: indusia hairy. Of greenhouse origin, native country unknown.

Other species cultivated under the name Lastrea, as *L. aristata* and *L. Richardsi,* belong to the genus Polystichum, which see.

L. M. UNDERWOOD.

LATÀNIA (East Indian name). *Palmàceæ.* Three species of fan palms from the Mascarene Islands. *L. Borbonica* is one of the dozen commonest trade names among palms, but the seeds offered under this name are said to be almost invariably those of *Livistona Chinensis. Latania Borbonica* of the botanists is properly *Latania Commersonii,* which has 3-seeded fruits, while those of *Livistona Chinensis* are 1-seeded. Latanias are tall, spineless palms, with solitary robust annular trunks: lvs. ample, terminal, long-petioled, suborbicular, palmately flabelliform, plicately multifid; segments smooth or spiny on the margins; rachis short; petiole 3-sided, concave above; ligule conchoidal; sheath short; spadices many feet long, compressed at the base and branches, sheathed with incomplete sheaths: staminate-fld. branches cylindrical, digitately arranged at the ends of the branches, very densely clothed with imbricated bracts: pistillate portion somewhat twisted. few-fld., sheathed with very broad dentate bracts: staminate fls. half-exserted beyond the bracts, the perianth smooth and shining: pistillate fls. larger: drupe globose, obovoid or pear-shaped, yellow. Allied genera are discriminated under *Hyphæne.*

A. *Lvs. glaucous.*

Lóddigesii, Mart. (*L. glaucophýlla,* Hort.). Lvs. 3–5 ft. long, very glaucous, primary veins slightly tomentose beneath, tinged with red, especially in young plants; segments 2 ft. long, less than 3 in. wide, unequally acuminate, the edges spiny in young plants; petioles 3–4½ ft. (or more) long, tomentose, entire in the mature, spiny in the young plant: drupe pear-shaped, 3-angled, 2½ in. long, 1¾ in. thick. Mauritius.

AA. *Lvs. not glaucous.*

B. *Petiole densely tomentose, with an orange margin.*

Verschaffèltii, Lemaire (*L. aùrea,* Duncan). Lvs. pale green, 4½–5 ft. long, the segments 2½ ft. long, above 2 in. wide, acuminate, the entire margins and veins slightly tomentose beneath; petioles 5–8 ft., densely tomentose, with entire orange margins, spiny in young plants: drupe slightly 3-angled, 2 in. long, 1½ in. wide. Isl. Rodriguez. I.H. 6:229.

BB. *Petiole red, slightly tomentose.*

Cómmersonii, Gmel. (*L. rùbra,* Jacq. *L. Bórbonica,* Lam., not Hort.). Lvs. 5–5½ ft. long, dark green above, paler beneath; segments lanceolate, acuminate, 2 ft. long. 3¼–3½ in. wide, their margins entire, spiny in young plants, veins and margins tinged with red; petiole 4–6 ft., slightly tomentose, the margins smooth, spiny in young plants: drupe globose, 1½–1¾ in. in diam. Mauritius. Not A.F. 4:567 and 7:127; A.G. 13:141; 15:389 and 19:557; V. 9:199, all of which are *Livistona Chinensis.*

JARED G. SMITH.

Latanias are essentially warmhouse palms and require moderate shading through the greater portion of the year, and also an abundance of water. A well-drained and rather light compost is most suitable for them, and if the soil at the time of repotting is of the same temperature as the house in which the plants are grown, there will be less risk of a check to the delicate rootlets. *L. Commersonii* is a particularly striking palm, the leaf-stems being quite long, smooth, and colored bright crimson, as are also the ribs of its fan-like leaves, this coloring being especially bright on the young foliage. *L. Loddigesii* is the strongest grower of the genus, the leafstalks reaching a length of about 8 ft., usually chocolate-colored and quite glaucous, the leaves thick and leathery and their ribs reddish while young, though never developing such bright tints as those of the preceding species. *L. Verschaffeltii* is also very attractive, though possibly a little more delicate than the other two, its leafstalks being long and rather slender, and orange-yellow in color, the ribs of the leaflets also yellow and the leaves themselves of a light shade of green.

L. erecta and *L. variegata* are trade names, the former being advertised by Saul, 1893; the latter by Pitcher & Manda, 1895. Any specimens in cult. will probably be found to be varieties of some of the above.

W. H. TAPLIN.

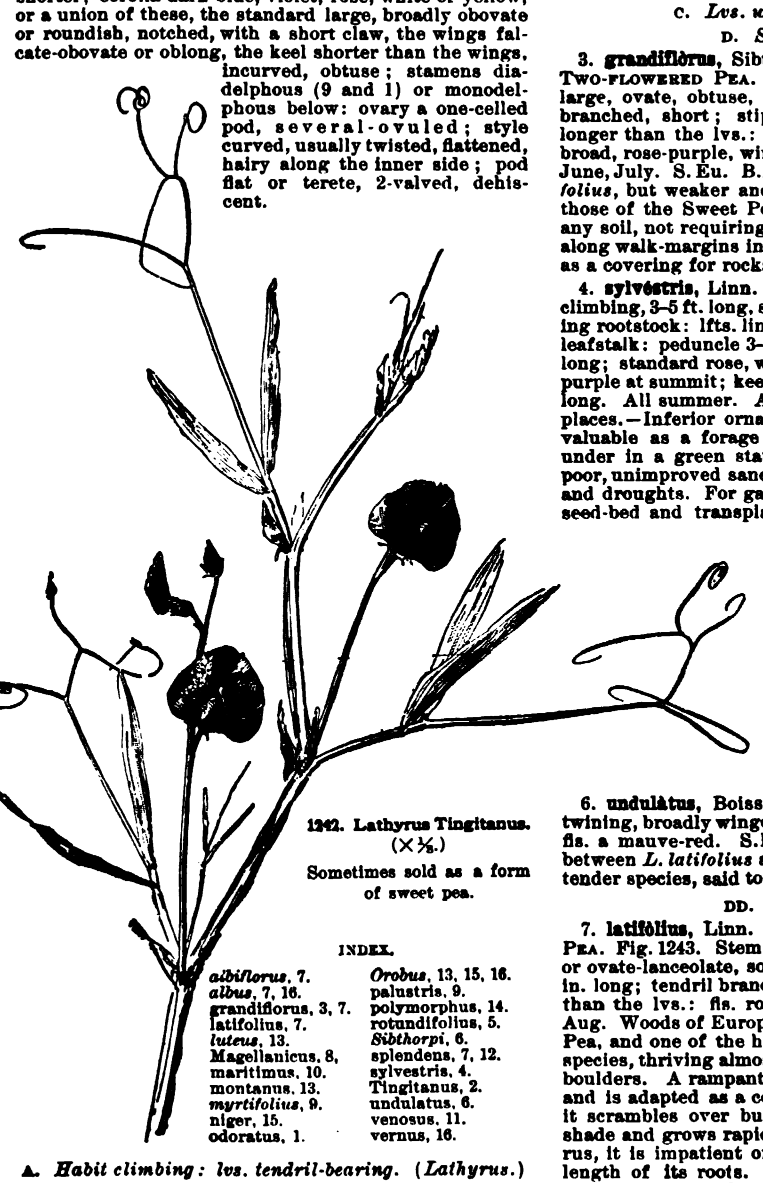
LÁTHYRUS (name used by Theophrastus for some leguminous plant). *Leguminòsæ.* A genus of about 100 species, occurring in the northern hemisphere and in South America, consisting of annual and perennial, climbing and upright herbs with pinnate lvs., half-sagittate stipules and showy, papilionaceous flowers.

The genus is best known by the Sweet Pea. Most other forms are perennial, although some of these are cultivated as annuals. All are free-growing plants, so independent in their ways that they require a place to grow by themselves, apart from other plants of like habit or size. Hence they are to be grown alone, on trellises or against walls, or allowed to form a wild tangle among strong shrubs. The chief value of the annuals is for cut-flowers, though their part in the garden is not to be ignored. As a temporary screen in summer for shutting out unsightly objects, they are valuable, or for quickly covering trellises or rough places otherwise unsightly.

The perennials are of comparatively easy cultivation, succeeding in any garden soil. The annuals are more exacting in their requirements, demanding a moderately rich garden soil, abundant moisture, coolness and depth for their roots, and open sunlight. All are grown from seed, sown very early in the open to secure the required coolness for the roots. The perennials are propagated, in addition, by division, special varieties being increased by cuttings in the fall, after the flowering season, or in spring, from old plants stored in the greenhouse. The roots of perennials are long and fleshy, and, when once established, continue for years without attention.

Orobus niger and *vernus* are common garden names, but Bentham & Hooker make Orobus a subgenus of

Lathyrus, characterized in part by the lack of tendrils. (See, also, *Orobus*.) Lathyrus has lvs. equally pinnate, ending in a tendril or in a point; lfts. 2 or several; stipules leafy, large and prominent, half-sagittate: fls. solitary or racemose, on long axillary peduncles; calyx oblique-campanulate, 5-parted, the upper teeth often shorter; corolla dark blue, violet, rose, white or yellow, or a union of these, the standard large, broadly obovate or roundish, notched, with a short claw, the wings falcate-obovate or oblong, the keel shorter than the wings, incurved, obtuse; stamens diadelphous (9 and 1) or monodelphous below: ovary a one-celled pod, several-ovuled; style curved, usually twisted, flattened, hairy along the inner side; pod flat or terete, 2-valved, dehiscent.



1242. Lathyrus Tingitanus. (×⅛.)

Sometimes sold as a form of sweet pea.

INDEX.

albiflorus, 7.
albus, 7, 16.
grandiflorus, 3, 7.
latifolius, 7.
luteus, 13.
Magellanicus, 8,
maritimus, 10.
montanus, 13.
myrtifolius, 9.
niger, 15.
odoratus, 1.
Orobus, 13, 15, 16.
palustris, 9.
polymorphus, 14.
rotundifolius, 5.
Sibthorpi, 6.
splendens, 7, 12.
sylvestris, 4.
Tingitanus, 2.
undulatus, 6.
venosus, 11.
vernus, 16.

A. *Habit climbing: lvs. tendril-bearing.* (*Lathyrus.*)

B. *Annuals: leaflets one pair.*

1. **odoràtus**. Linn. Sweet Pea. Stem rough-hairy, winged: lfts, oval or oblong, mucronulate; stipules lanceolate peduncle 2–4-fld., much longer than the lvs.: fls. in shades of blue, red, yellow and white, fragrant, the shield large and showy, expanded, sometimes "hooded:" pod 1–2 in. Summer. Sicily. B.M. 60.—For culture and varieties, see *Sweet Pea*.

2. **Tingitànus**, Linn. Tangier Scarlet Pea. Fig. 1242. Sts. spreading, winged, glabrous, 3 ft. long: lfts. linear-lanceolate, obtuse, mucronulate; stipules lanceolate: peduncle 2-fld., longer than the lvs.: fls. 1 in. long, dark red-purple; shield large, purple, wings and keel bright red: pod 4–5 in. long. June, July. W. Mediterranean region. B.M. 100.—An earlier annual than the Sweet Pea, and because of its vigor should be kept away from it or it will run it out.

BB. *Perennials.*

C. *Lvs. with 1 pair of leaflets.*

D. *Stipules narrow.*

3. **grandiflòrus**, Sibth. and Sm. Everlasting Pea. Two-flowered Pea. Stem winged, 4–6 ft. long: lfts. large, ovate, obtuse, mucronulate, undulate; tendrils branched, short; stipules small: peduncles 2–3-fld., longer than the lvs.: shield large, obcordate, notched, broad, rose-purple, wings dark purple: pod linear, 3 in. June, July. S. Eu. B.M. 1938.—Larger vine than *L. latifolius*, but weaker and less rampant. Fls. as large as those of the Sweet Pea. Free-flowering, succeeding in any soil, not requiring much light. Adapted to banks, along walk-margins in woods, among strong shrubs, and as a covering for rocks.

4. **sylvéstris**, Linn. Flat Pea. Stem straggling or climbing, 3–5 ft. long, stout, winged, glabrous, with creeping rootstock: lfts. linear-lanceolate, thick, with winged leafstalk: peduncle 3–6-fld., equaling the lvs.: fls. ½ in. long; standard rose, with green spot on its back; wings purple at summit; keel greenish: pod lanceolate, 2–3 in. long. All summer. All Europe, in thickets and rocky places.—Inferior ornamentally to other perennials, but valuable as a forage plant for cattle and for plowing under in a green state as a fertilizer. Grows well on poor, unimproved sandy soil, and is unaffected by frosts and droughts. For garden culture, it may be sown in a seed-bed and transplanted when of suitable size. Its seeds in the wild state are said to be to some degree unhealthful, but in the cultivated form this quality has been bred out.

5. **rotundifòlius**, Willd. Persian Everlasting Pea. Low-growing, winged species: lfts. ovate: stipules toothed: peduncles many-fld., longer than the lvs.: fls. large, rose-pink. June. Russia and the East. B.M. 6522.—A species of easy culture, requiring a cool, shady and sheltered position. Adapted to stony banks.

6. **undulàtus**, Boiss. (*L. Sibthorpi*, Baker). Stems twining, broadly winged: lfts. oblong: peduncle 5–6-fld.: fls. a mauve-red. S.B.F.G. 333.—A form intermediate between *L. latifolius* and *L. rotundifolius*. A somewhat tender species, said to be 6 weeks earlier than any other.

DD. *Stipules broad.*

7. **latifòlius**, Linn. Everlasting Pea. Perennial Pea. Fig. 1243. Stem winged, 4–8 ft.: lfts. ovate-elliptic or ovate-lanceolate, somewhat glaucous, mucronate, 2–3 in. long; tendril branching: peduncle many-fld., longer than the lvs.: fls. rose, large: pod flat, 4–5 in. long. Aug. Woods of Europe.—This is the common Perennial Pea, and one of the hardiest and most easily cultivated species, thriving almost anywhere, even among flags and boulders. A rampant grower, it is a good trellis plant, and is adapted as a cover to wild, rough places, where it scrambles over bushes and stones. It succeeds in shade and grows rapidly, but, like all species of Lathyrus, it is impatient of removal, owing to the size and length of its roots. Has no place in the border. Its varieties are not clearly defined. Var. **álbus**, Hort., the white form, is adapted to the same uses as the type, and is, besides, valuable to florists wanting white flowers in midsummer. Var. **spléndens**, Hort., dark purple and red, is said to be the best form of the type, but does not come true from seed. There is a striped form, also. Other trade names are vars. **albiflòrus** and **grandiflòrus**.

8. **Magellánicus**, Lam. Lord Anson's Blue. Stem 3–5 ft. long, smooth, angled, somewhat branched: lfts. ovate or oblong-linear; tendrils branched; stipules cordate-sagittate, broad: peduncles long, 3–4-fld.: fls. dark purple-blue. June, July. Straits of Magellan. S.B.F.G. II. 344.—A strong-growing, woody, almost evergreen

species covered with a bluish bloom. Since it is a maritime plant, salt is said to assist its growth. It is sometimes regarded as an annual. Var. **álbus**, Hort., "LORD ANSON'S WHITE," is the white form.

CC. *Lvs. with more than 1 pair of leaflets.*

9. **palústris**, Linn. MARSH PEA. WING-STEMMED WILD PEA. Stem slender, 1–3 ft. long, glabrous or somewhat pubescent, often winged, rather erect: lfts. 2–4 pairs, oblong-lanceolate, acute, 1–2 in. long; tendrils branched; stipules small, lanceolate: peduncles 2–8-fld., scarcely longer than the lvs.: fls. purplish, ½ in. long: pod 2 in. long. Summer. Northern N. America and N. Europe, in moist places.—A good bog plant. Var. **myrtifòlius**, Gray (*L. myrtifòlius*, Muhl.). MYRTLE-LEAVED MARSH-PEA. Has smaller, obtuse lvs., broader and larger stipules, the fls. pale purple. July, Aug. Banks of rivers, northern North America to N. C.

10. **maritimus**, Bigel. SEA OF SEASIDE PEA. BEACH PEA. Stem stout, 1–2 ft. long, angled, decumbent: lfts. 3–6 pairs, ovate-oblong, thick, glaucous, nearly blue, 1–2 in. long; stipules leaf-like, broadly ovate and cordate-hastate: peduncles 6–10-fld., a little shorter than the lvs.: fls. purple; wings and keel paler, ¾ in. long: pod 1½ in. long, hairy. May–Aug. Gravelly seacoasts throughout northern hemisphere.—A spreading plant with creeping rootstock and of rapid growth, very tenacious of life. A good plant in rock gardens and in gravelly soil.

11. **venòsus**, Muhl. SHOWY WILD PEA. Stem stout, 2–3 ft. long, finely pubescent, strongly 4-angled: lfts. 4–6 pairs, oblong-ovate, obtuse, often pubescent below, 2 in. long; stipules narrow, short: peduncle crowded, 8–16-fld., rather shorter than the lvs.: fls. purple, 6–8 lines long: pod smooth. June, July. Shady places and along streams, Canada to Ga. S.B.F.G. II. 37.

12. **spléndens**, Kellogg. PRIDE OF CALIFORNIA. Stem subshrubby, slender, more or less soft-pubescent: lfts. 4–6, ovate-oblong to linear, ½–1 in. long, acute; stipules narrow: peduncle 6–12-fld.: fls. pale rose or violet, large. Dry hills of coast ranges, Calif. Gn. 52:1133.—A greenhouse plant 1 ft. long or more, becoming 8–10 ft. at home, where it dies down during the summer. Elsewhere it adapts itself to climate but is not hardy in N. United States. Sometimes confused with a variety of *L. latifolius*.

1243. Lathyrus latifolius. (×⅓.)

AA. *Habit not climbing: lvs. not tendril-bearing.* (*Orobus.*)

B. *Fls. yellow.*

13. **montànus**, Bernh. (*Órobus lùteus*, Linn. *L. lùteus*, Baker). Stem simple, angled, smooth: lfts. 5–8 pairs, large, elliptic-lanceolate, pointed, glaucous below: peduncles many-fld., a little shorter than the lvs.: fls. large, orange-yellow. June, July. Forests of the Alps. S.B.F.G. II. 115.—A shade-enduring species with fls. in erect, spike-like clusters and adapted to borders and rockeries.

BB. *Fls. not yellow.*

14. **polymórphus**, Nutt. PRAIRIE VETCHLING. Stem rather stout, usually low, glabrous or finely pubescent, erect, a little woody at the base: lfts. 3–6 pairs, scattered, narrowly oblong, acute, thick, 1–2 in. long; stipules narrowly acuminate: peduncle 2–6-fld., a little longer than the lvs.: fls. purple, large. March–July. Grassy, alluvial plains, Colo. to New Mex. and Ariz.

15. **niger**, Bernh. (*Órobus niger*, Linn.). BLACK PEA. BLACK BITTER VETCH. Stem erect or ascending, branched, angled, 1–2 ft. long: lfts. 6–8 pairs, elliptical or ovate, ½–1 in. long, light green, turning black when drying; stipules narrow, small: peduncles 6–8-fld., longer than the lvs.: fls. purple, small. June, July. Mountainous and rocky districts, Middle Europe. B.M. 2261.—Slender species, with short rootstock, succeeding in the shade.

16. **vérnus**, Bernh. (*Órobus vérnus*, Linn.). SPRING BITTER VETCH. Stem simple, somewhat pubescent, 1–2 ft. long: lfts. 2–3 pairs, ovate-acuminate, light green; stipules entire: peduncles 5–7-fld., shorter than the lvs.: fls. blue-violet; keel shaded with green, nodding. May, June. Hills and woods, S. and central Europe. B.M. 521.—The most popular Orobus; a compact, tufted plant, growing quickly in sun or a little shade; best in deep, sandy loam, in a sheltered position; hardy. Var. **álbus**, a white form, is rare.

L. galègiformis and *L. Helvéticus* are names in the American trade, but cannot be placed botanically.—*L. tuberòsus*, Linn., has been imported by an American amateur. It differs from all described above by having tubers. It is a native of the northern parts of the Old World, and bears red flowers, which are generally fewer and smaller than those of L. sylvestris.

A. PHELPS WYMAN.

LAUREL. Properly *Laurus nobilis*, but other broad-leaved evergreens have taken the name. In America, the Kalmias are known as Laurels. The Cherry Laurel is *Prunus Lauro-cerasus*, and in America *P. Caroliniana*. Portugal Laurel, is *P. Lusitanica*. Ground Laurel is Epigæa.

LAURESTINUS. Popular name of *Viburnum Tinus*.

LAUROCÉRASUS. Consult *Prunus*.

LAÛRUS nóbilis (Laurus is the ancient name) is the Sweet Bay tree of the florists, the most universal of all evergreen tub-plants. It is native to the Mediterranean region, sometimes attaining a height of 40 to 60 ft., but rarely assuming a true tree-like form. As a cultivated subject, it is grown as a small standard tree, with a close-sheared top. The plant endures abuse and neglect, the head can be trimmed to almost any shape, and the growth may be kept within small limits year after year. F.R. 1:669 (Fig. 1244). It is, therefore, the most popular of plants for decoration of open-air or exposed restaurants, esplanades, architectural appurtenances, and the like. Although much used in America, it is still more popular in Europe. Of the European dealers one may order plants with heads trained to pyramids, cones, globes, and the like, and with bodies long or short. The plant will endure considerable frost. It is grown in the open in England: "The Sweet Bay bush in the farmer's or cottage garden comes with its story from the streams of Greece, where it seeks moisture in a thirsty land along with the wild Olive and the Arbutus. And this Sweet Bay is the Laurel of the poets, of the first and greatest of all poet and artist nations of the earth—the Laurel sacred to Apollo, and used in many ways in his worship, as we may see on coins, and in many other things that remain to us of the great peoples of the past" (Gn. 47, pp. 301, 307). Although so universally used, there are few important horticultural varieties,—the variegated-leaved and crisped-leaved forms being the best known. Prop. by cuttings, and sometimes by seeds.

Laurus gives name to the family *Lauràceæ*, which includes Cinnamomum, Camphora, Persea, Sassafras, Benzoin, and other genera. Many species have been referred to Laurus, but with the exception of two, these species are now placed in other genera. These two true Lauruses are *L. nobilis*, Linn. (the subject of this sketch), and *L. Canariensis*, Webb & Berth., of the Canary Islands. The fls. are diœcious or perfect, small and inconspicuous, in small, axillary umbels; perianth with a short tube and a 4-parted limb; stamens 8–12 or more, and staminodia often present: ovary sunk in the receptacle, the style short: fr. a small berry.

The Sweet Bay (*L. nobilis*) has stiff, dull green, entire, alternate lvs. lanceolate or lance-oblong in shape: yellowish fls. in early spring: succulent, purple, cherry-like fruits. The lvs. are sometimes used in cookery and the making of confections, because of their pleasant aromatic flavor. The wreaths with which the heroes of antiquity were crowned were made of Laurel leaves.

1244. Laurus nobilis in tubs.

Laurus Benzoin of trade catalogues is *Benzoin odoriferum*. *L. Sassafras* is the Sassafras tree. *L. Camphora* is the Camphor tree (see *Camphora* and *Cinnamomum*). L. H. B.

It is estimated that several hundred thousand Bay Trees are sold every year in Europe and America. They are mostly imported from Belgium and Holland, where they are cult. as follows: Cuttings 3–4 inches long from well-ripened wood are put in sharp sand, either under bell glasses or in glass cases. Bottom heat is not essential. After the cuttings have rooted, they are potted in small pots, in fairly rich sandy loam, with good drainage, and can then be put in a hotbed, with some gentle bottom heat, where they will at once make a good strong growth. After this they are, as a rule, planted in nursery rows, in rich sandy soil, with perfect drainage. They will make a strong shoot 3 to 5 feet in length in one season. These shoots are tied up to stakes. At the end of the growing season and long before the cold weather sets in, these young plants, together with their stakes, are taken up and put into their winter quarters, which, as a rule, is a well-lighted and ventilated shed—an ordinary barn-like shed, sometimes built several feet into the ground and provided with sky-lights and ventilators. These plants are set in close rows and watered once or twice a week, according to the weather. Little or no fire heat is used in these sheds unless the weather gets extremely cold. The temperature is kept just above freezing. In the spring they are taken out and either potted and plunged in nursery rows, or planted out, as before. Plenty of water, rich peaty soil and the congenial moist atmosphere near the seacoast induces them to make a fast and luxuriant growth. Thus they are cultivated continually until the plants have been trained into the desired form, and as soon as they have attained enough of this form to show their character, which usually is from 5 to 6 years after propagation, they are planted in properly proportioned hardwood tubs and are then ready for the market, or to be further cultivated, perhaps for a good many years, until they grow into large specimens. The trees are cut back and trimmed into shape once a year, after the new growth is well matured.

The peaty muck soil in which they are grown abroad is very deceptive to Americans, and many fine trees have been ruined by not understanding its nature. Its dark color always makes it look moist. Sometimes when the soil looks moist enough the trees are really dying from drought.

In retubbing trees there is danger of using for filling material a soil that is too heavy. The water then runs into the new soil, leaving the old soil dry. If the trouble is not detected soon the trees may be spoiled. The only thing to do in such cases is to comb out the old ball and cut back to live roots. The tree can then be planted in the open to gain a new set of roots, after which the top can be cut back to live wood. The tree may thus be eventually brought into a good shape again.

As a rule, Bay Trees are not good house plants. They do not like the dry heat of a dwelling. They can, however, stand considerable heat if they have plenty of fresh air and plenty of water. In spring and early summer, when they are making and finishing their growth, they can stand any quantity of liquid manure or of strong manure mulching, for they are great feeders. Many people erroneously suppose that this tree affords the bay rum of commerce. The cured leaves of the Sweet Bay are used in putting up packages of rice, and impart a rich and agreeable aroma. H. A. Siebrecht.

LAVÁNDULA (Latin, *lavo*, to wash; referring to the use of Lavender in the bath). *Labiàtæ*. This genus includes the Lavender (*L. vera*), an ancient garden favorite because of its pleasant odor. The genus contains about 20 species, scattered from the Mediterranean region to India; perennial herbs, subshrubs or shrubs: lvs. commonly crowded at the base, pinnatifid or dissected: whorls 2–10-fld., crowded into long-peduncled cylindrical spikes, which are unbranched or branched from the base: fls. blue or violet; calyx tubular, 13–15-striated, 5-toothed; corolla lobes nearly equal, or the posterior lip 2-cut, the anterior 3-cut; stamens 4, didynamous, declined, included in the tube; style shortly 2-cut at the apex. In the North, winter protection should be provided for Lavender. The plant grows naturally in dry and hilly wastes. J. B. Keller advises a light, open soil.

A. *Spike loose: upper floral lvs. fertile, shorter than the calyx.*

B. *Lvs. not densely woolly.*

vèra, DC. Lavender. Subshrub, 1–3 ft. high: lvs. oblong-linear or lanceolate, entire; younger ones often clustered in the axils, white-tomentose, revolute at the margins; older ones greener, 1–1½ in. long: spikes interrupted: whorls 6–10-fld. Summer.

Spica, Cav. Dwarfer than the true Lavender, whiter, the lvs. more crowded at the base of the branches, spike denser and shorter. The floral lvs. are lanceolate or linear (rhomboid-ovate acuminate in *L. vera*), and the bracts are linear-awl-shaped, shorter than the calyx, while in *L. vera* the bracts are almost absent.

BB. *Lvs. densely woolly.*

lanàta, Boiss. Differs also from the preceding in having much longer and less crowded spikes. Woolson says it grows 1–2 ft. high and needs winter protection at Passaic, N. J.

AA. *Spike dense: upper floral lvs. sterile, comose.*

B. *Lvs. entire.*

Stœ̀chas, Linn. Shrub, 2–3 ft. high: lvs. tomentose, about ½in. long: spikes short-peduncled, densely comose: fls. dark purple. Cult. only in S. Calif.

BB. *Lvs. obtusely pinnate-dentate.*

dentàta, Linn. Lvs. pubescent: spikes long-peduncled: fls. deep purple. Mediterranean region. B.M. 400. —Int. 1900 by Franceschi. W. M.

Lavender (*L. vera*, DC.), a labiate shrub, 2–3, sometimes 6 ft. tall, with green or glaucous lvs, and flowers in cylindrical, terminal spikes, of a blue tint named from them, is a native of Persia, the Canaries, and the Mediterranean region, covering vast tracts of dry land in Spain, Italy and southern France, cultivated largely in the last-named country and in the counties of Surrey and Hertfordshire, England.

In the eastern United States it is grown in but few gardens, but in California, where climatic and soil conditions seem favorable, it is more commonly planted, though not upon a commercial scale. The dry soil of that state and the light limestone soil of the Black Belt of Alabama and adjacent states seem to be most inviting to this industry.

The generic name is derived from the ancient use of its flowers and leaves in bath perfumery. The flowers long retain their strong, fragrant odor after drying, and upon distillation yield a lemon-yellow, very fluid oil of aromatic, bitterish, burning taste. Though this is officinally credited with stimulant and tonic properties, it is seldom administered in the pure state. Its chief uses are in the manufacture of perfumery, aromatic vinegar and lavender water, an alcoholic solution of the oil and other odorous substances. For these purposes, English oil has long commanded the highest price, but recently the French product has been claimed superior. Though all parts of the plant are aromatic, and both leaves and flower-stems are used in oil manufacture, oil obtained in the first half hour of distillation from flowers alone is much superior to the later distillate and also to the oil obtained from a mixture of flowers and stems. These grades, and also the highly valued product of very dry seasons, are always sold separately.

Lavender is best propagated by cuttings of one season's growth taken with a heel of older wood, in late autumn or early spring. When set 3–4 in. asunder in rather moist soil and shaded, they strike more readily and produce more symmetrical plants than older wood. Seed does not propagate desired varieties, and division is not advised, since plants so obtained are more susceptible to disease than those made from young-wood cuttings. After danger of frost, the 1-year-old plants are set 4 ft. asunder in rows 6 ft. apart, running north and south. Closer planting and the hedge-method yield a smaller quantity of bloom. Dry, light, calcareous, even stony soils upon sites where sun and air are unimpeded by trees, etc., favor this plant. Upon such fewer are injured by frost, and the oil is of superior quality. In moist soil so much water enters the plant as to enfeeble it, and upon rich lands yield and quality both suffer. Light fertilizing with stable manure or ashes turned under in autumn, and spring harrowing, are advised. During the first year in the field the plants should be clipped to prevent flowering and to encourage stockiness. Vigorous plants so treated may grow to a height and a diameter of 5 ft., and when 2–4 years old produce secondary bloom spikes after the general harvest, which usually occurs in early August. Plantations should be destroyed when 4–6 years old and the land rested with other crops before setting to Lavender again. Cutting in clear weather, in early blossom, before the dew is off and at once distilling give best results; but no delay should occur. Cutting in wet weather, in the heat of the day, holding blossoms long before distilling and exposing them to the sun after cutting result in serious losses. One pound of flowers yields from ½–1 drachm of oil, and an acre from 10–25 pounds. The annual output of the stills of Grasse, France, is from 80,000 to 100,000 kilogrammes.

"Oil of spike," obtained from a broad-leaved, much whiter and smaller species (*L. Spica*), is less fragrant than true Lavender oil, being analogous to oil of turpentine, with which it is often adulterated. It suggests the odor of rancid cocoanut oil. Officinally, it is credited with carminative and stimulant properties, and has been found useful in nervous languor and headache. It is used by artists in the manufacture of varnishes, by porcelain painters, and to a small extent in perfumery, mainly as an adulterant. From 20,000 to 25,000 kilogrammes are annually produced at Grasse.

M. G. KAINS.

LAVATÈRA (two Lavater brothers, physicians and naturalists at Zurich, friends of Tournefort). *Malvàceæ.* About 18 species of widely scattered herbs, shrubs and trees, tomentose or hairy: lvs. angled or lobed: fls. sometimes 2–4 in. across, variously colored, rarely yellow, solitary in the axils or borne in terminal racemes; column of stamens divided at the summit into an indefinite number of filaments; petals 5.

The genus has 5 near allies of garden value, which are all distinguishable by their bractlets. In Lavatera and Althæa they are grown together at the base; in Malva and Callirhoë they are free all the way, sometimes absent in Callirhoë; Sidalcea has none at all. Lavatera is further distinguished from Althæa by having 3–6 bractlets (Althæa having 6–9), and the axis of the fruit surpassing the carpels, which is not the case in Althæa. These plants are of the easiest culture, the first species being the commonest, and all prop. by seeds. There seem to be no double forms. They are far less popular than Hollyhocks.

A. *Annual, herbaceous.*

triméstris, Linn. Height 3–6 ft.: lvs. nearly glabrous, upper ones angled: fls. rosy, 4 in. across: receptacle or axis of the fr. expanded at the apex into a disk, inclosing the ovary. Mediterranean region. Var. **álba** has white fls. Gn. 24, p. 89; 51, p. 212 and 53:1154. B.M. 109.

AA. *Biennial or perennial, shrubby or tree-like.*

B. *Foliage variegated.*

arbòrea, Linn. Biennial, woody at the base, with annual flowering branches, forming a shrub 3–5 ft. high or less: lvs. 5–9-lobed, softly downy on both sides, rarely nearly glabrous: fls. pale purple-red, about 2 in. across: receptacle small, marked with little pits, not exserted. Cult. only in the form of var. **variegàta**, which has mottled lvs. Gn. 23, p. 114. V. 8:99.

BB. *Foliage not variegated.*

C. *Fls. 1–4 in the axils, pedicelled.*

assurgentiflòra, Kellogg. Presumably perennial, shrubby, 6–15 ft. high: lvs. glabrous or sparingly stellate-pubescent, 5–7-lobed, 3–6 in. wide: fls. purple; petals 1–1½ in. long, with long, narrow, glabrous claws, and a pair of dense, hairy tufts at the base: axis of the fr. low-conical, about as long as the carpels. Anacapa Island. Cult. only in S. Calif.—Franceschi says it makes a large, round-headed shrub, with large red fls., and is one of the best plants to stand saline winds.

CC. *Fls. solitary, sessile.*

Ólbia, Linn. Perennial, shrubby, about 6 ft. high: hairs of the stem pilose, somewhat clustered, distant: lvs. softly tomentose, lower ones 5-lobed, upper 3-lobed, highest oblong, scarcely divided: fls. reddish purple. S. Eu.—Not advertised in America, but commonly cult. in England, where it occasionally sows itself.

W. M.

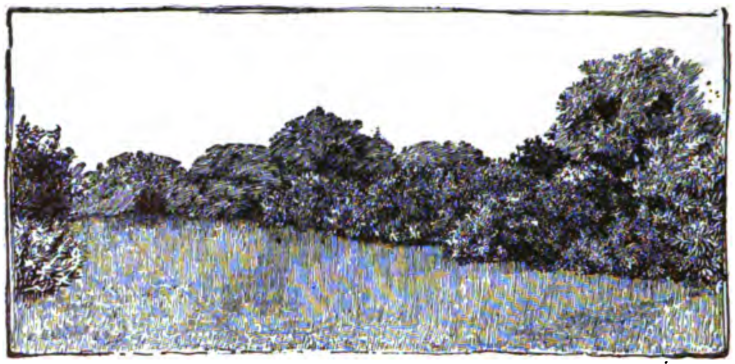
LAVENDER. See *Lavandula.*

LAVENDER COTTON is *Santolina Chamæcyparissus.*

LAVIA, of one nursery catalogue, is a typographical error for *Layia.*

LAWN. For most people the word Lawn bears a vague meaning, compounded of their recollection of grass-covered spaces dotted over with trees and shrubs, and of broad areas covered simply with closely-mown turf. Both are correct impressions: but the more important feature is that a Lawn shall be an open area of grass space (Figs. 1245, 1246). Many exceptions or additions to this definition may, however, be admitted. A great white oak, for instance, rugged and picturesque against the evening sky, needs only to be seen to furnish an ample excuse for its retention on any Lawn. But this would be a happy chance, not affecting the principles which should govern the construction of a Lawn on an open area.

It may readily appear that the Lawn will, as originally designed, prove too sunny or too strongly wind-swept over its extended expanse; but the remedy for this will be found to lie not so much in planting single trees or detached groups of trees over the uncovered area, as in extending limbs, points, promontories and peninsulas of trees, or trees and shrubs, directly out from the main



1245. An open area of grass space.

body of bordering plantations which will usually frame the Lawn and the different pictures that will appear in any properly unified scheme of landscape gardening. The art of the designer will display itself in determining the relative sizes of the Lawns and these enclosing or framing plantations. A careful eye must, of course, be given to the individuality of the Lawn itself, which should never be allowed to merge into the neighboring plantations. A like principle applies to all kinds of art—it is fundamental and vital in its character. The reader may fancy that its application would tend to limit the beauty of landscape gardening by eliminating certain features of natural beauty, such as trees, shrubs and beds of flowers, but, if he will look at an open Lawn with discerning and sympathetic eyes, he will find that the "moving cloud-shadows, waving grass, rich patches of dark and light green, studded with the starry radiance of the humble flora of the grass, and the hundred incidents of blazing or subdued color and form that appear on the surface of an open meadow," need no added beauty of tree or shrub to perfect their nearly unapproachable loveliness. So important does the writer consider the essential and peculiar beauty of the Lawn as distinguished from that of any other part of the home domain, that he always feels inclined to term it the true focus of the picture, the central point of interest in any landscape gardening design.

This being the case, it behooves us always to literally leave no stone unturned or clod of earth untilled and unfertilized in order to obtain a satisfactory open Lawn. Did the reader ever really see such an one? Let him answer frankly to himself whether he has or has not seen a Lawn which showed no traces of twitch grass and other early weeds in July, nor any summer grass and later weeds in August and September,—above all, a Lawn which would stand a protracted drought without artificial watering. Very likely he will think it is impossible to make such a Lawn under the conditions of soil and climate which each and all of us are likely to believe specially characteristic of the spot of ground on which we live. Perhaps, on the other hand, he will declare that he has seen such a Lawn in some remote place, but if we question him, ten chances to one we shall find that his observation of this exceptional Lawn is limited—that he has not wintered and summered near it, or seen it during its periods of "storm and stress." The writer knows one place where such a Lawn can be seen, and he refers to it, not because it is properly a Lawn, for it lacks the requisite framing plantations; but it is perfect in the first essential of a good Lawn—it is a piece of perfect Lawn grass. A brief description will show how this standard of excellence was reached. The Lawn consists of small patches of grass turf on a private farm in Manchester, Conn. Each patch was worked and turned over with various ingeniously contrived hoes, forks and rakes until the last lurking weed was removed that could be found by dint of skill and untiring patience. The soil was that of an old garden, and naturally good. It was tilled in the most thorough manner and not fertilized at all, for fear new weeds be introduced. Then, in this mellow and receptive medium, were set cuttings or joints of the hardiest and most luxuriant varieties of grasses which had been discovered by months and even years of keen and intelligent search in the old meadows of both the Old and the New World from Austria to Australia. The result is an elastic firmness, an endurance, depth and richness of the turf which suggests to the tread the deep pile of some Eastern carpet woven in a hand-loom.

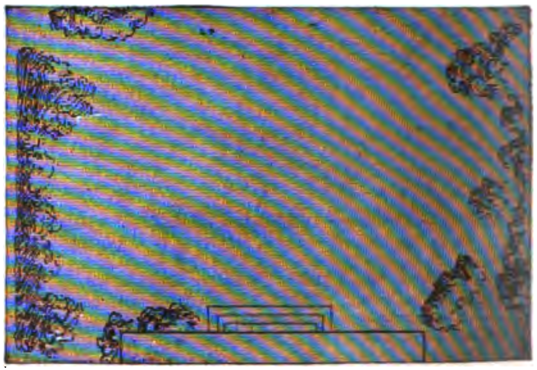
But all can not attain this standard on their Lawns. For those who do not look higher than the ordinary standard—and even this is none too often desired, or even understood, by the general public—the following directions for Lawn making may be given:

1. The Lawn should be carefully graded, either convex, level or concave, in such comparatively long, suave and graceful lines as will accord with the peculiar conformation of the ground (Fig. 1247).

2. Plow, harrow or spade, and fork the soil of the Lawn to a depth of two feet, if possible, and keep removing the stones and burning the gathered rubbish for several weeks, or as long as you can persuade yourself to do it, or pay any one else to do it, with the full assurance that no matter how much you do, you will not be likely to destroy all the weeds and win the very best possible results.

3. Enrich the soil by a covering of still richer mold. Next to this in efficiency are bone dust, superphosphate of lime, nitrate of soda, and nitrogenous manures like ground flesh and bone mixed in proportions suited to the special soil, which may vary materially in a distance of a few hundred yards. The usual proportions are one ton to the acre of ordinary artificial fertilizers, such as superphosphate of lime and bone dust, or 15 to 25 of well-rotted stable manure. If artificial fertilizers are not available, then take cow manure, sheep manure, or last of all, because it is the most productive of weeds, ordinary stable manure. These natural manures are, after all, the best, save for their weed-bearing qualities. They will need composting with several times their bulk of good soil and evenly spreading and harrowing or raking in throughout the surface of the Lawn.

4. For turfing, the cleanest grass seed that can be obtained at any price will be found the best in the end.



1246. Ground plan of a nature-like garden.
To show relative importance of lawn and planting.

The bulk of this seed should be Kentucky blue-grass or June-grass (*Poa pratensis*) mixed with red-top or herd's-grass (*Agrostis alba*, var. *vulgaris*), or *Agrostis canina*, the Rhode Island bent-grass. The advantage of using several kinds of grass is that the first-comers hold possession of the ground against incursions of weeds until the stronger but slower-growing Kentucky blue-grass gets complete root-hold, when, in the struggle for life, the earlier growths of grass, being weaker, go to the wall and are crowded out of existence. How fine this blue-grass may become under favorable conditions it will be needless to point out to those who have seen the grass meadows of Kentucky.

5. On a quiet day the seed should be sown evenly over the Lawn surface—a task which can be well done only by much skill and experience. The ground will then need careful raking with a fine-toothed iron rake, and rolling with an iron roller, the heavier the better. In very dry and windy weather it is hardly worth while to sow grass seed.

1247. An easy grade for a steep lawn.

6. As soon as the grass has grown 3 or 4 inches, cut it first with a scythe and afterwards with the Lawn mower, in order to secure a good, thick-set turf. Every spring, and oftener if wet weather prevails, a compacting with the iron roller will serve a good purpose. Fertilizing on the top of the Lawn in the winter is always in order, provided the remainders of rubbish from the stable manure that may be used be removed early in spring before the grass starts.

7. The last and perhaps the most important care to be given the Lawn in the process of its establishment is the weeding of the first summer. The next is the weeding of the second summer—and the third is the weeding at any time it may need it, no matter how many years may have elapsed since its construction. The onion patch and the flower garden need no more weeding than the Lawn, if for no other reason than because the use and beauty of either onion patch or flower garden can never, combined, equal those of the home Lawn. In it, skill and patience and the love of beauty find abundant reward.

SAMUEL PARSONS, JR.

LAWNS FOR THE SOUTH.—The scarcity of handsome Lawns throughout the South often leads to the impression that the cause is from a lack of proper grasses possessing sufficient resisting power to withstand the long, warm summers. This idea is, unfortunately, widely entertained, and, as a consequence, one of the most pleasing features of landscape gardening is lost. The principal cause which has led to this opinion is from the endeavor, in the formation of Lawns, to use the many kinds of grass seeds which are so successful in the northern states and which are unsuited for southern soils and climate, unless in a few exceptional localities.

Sown during the fall months in properly prepared land, a very good stand can be had during winter and early summer, but unless there is sufficient moisture, either from copious rains or liberal irrigation, most of those otherwise excellent grasses fail and die out during a protracted drought. Lawns of an extensive area, when formed with northern and European grasses, are therefore unadvisable South, but where the extent is limited, the soil deeply dug, well fertilized and artificial irrigation available, then a very satisfactory result may be expected. Several Lawn grass mixtures are recommended, but the best that has come under our observation is the formula known in Philadelphia as "Evergreen Lawn Mixture."

There are, however, several native and exotic grasses, which not only resist the long summer heat, but, if properly treated, afford most excellent Lawn-making material. First of all is the Bermuda grass (*Cynodon* or *Capriola*), a plant of trailing and stoloniferous habit. Although it is known throughout the southern states under the name of Bermuda, it is, however, a native grass of Bengal and other sections of India, and found, also, in Corea. In Bengal it is known as "Doob grass," and there highly prized for its vigorous growth of a soft, dark hue, and thriving where scarcely any other kind will. This grass has become widely disseminated throughout the South, where it has received both the harshest possible reputation as a nuisance when allowed to take a foothold in cultivated fields and gardens, as well as unstinted praise from those who have learned its great value as a pasture, hay or Lawn grass.

When required for Lawns, the roots should be cut in short lengths,—passing them through a hay cutter is the most expeditious. Let the ground be well and deeply plowed or dug, well manured, and after sowing the pieces of grass roots they must be either raked or harrowed in, then the surface made perfectly level by rolling; or, where the area is limited, the roots may be planted 6 inches apart. Plant at any time during February or March, or in the fall if preferred. If during the spring the soil should become very dry, an occasional watering, where this is practicable, should be attended to until the grass is well established. Neither excessive heat or cold will kill the roots if left undisturbed, but plowing up during warm weather will soon rid the ground of the roots if this is desired. As the new growth attains a few inches in height, use the Lawn mower every week or ten days during moist weather, but even during dry weather the grass must be kept occasionally clipped to prevent flowering. If the growth is not vigorous, apply a top-dressing of bone meal. In the fall a coat of well-rotted stable manure should be given; this may be raked off early in the spring, previously running a sharp-toothed harrow over the Lawn, and finally rolling it well. In this way a permanent and good Lawn may be secured with very little additional expense. Any soil, unless naturally very wet, will suit Bermuda grass.

Paspalum distichum, or "Joint grass," is native of the southern states, and usually found in moist or low grounds. It can be utilized in soils which are too wet to suit the Bermuda, but at best makes an indifferent Lawn, as it is of low-creeping and not sufficiently dense habit.

Rottbœllia rugosa, known on the coast belt and Florida as "Goose grass" (St. Augustine grass), is an erect-growing perennial plant, with flat or channelled leaves. It is found in pine-barren swamps and ponds from Florida to North Carolina, and being well adapted to the sandy soils of the coast, even those which are commonly termed salt-water lands, it is therefore valuable for such localities. As for the Bermuda, the soil should be well fertilized and prepared. The rootlets are planted in rows a few inches apart. As the growth begins, repeated clippings are required. While it makes a coarse sod, still its bright green color and adaptability to soils where few other grasses of low growth are possible, makes it a valuable plant for Lawns.

Many Lawns are injured by allowing other grasses to take a foothold. *Sporobolus Indicus*, or "Smut grass," was originally introduced from the West Indies. It soon forms large tufts, with tall, wiry stems, whose panicles are usually covered with a black fungous growth. *Aristida purpurascens*, or "Broom Sedge," will soon deface a Lawn if left undisturbed. Both should be eradicated as soon as they appear.

P. J. BERCKMANS.

LAWSÒNIA (after Dr. Lawson, who published in 1709, at London, an account of his botanical journey in Carolina). *Lythràceæ*. This genus includes a tropical shrub, cult. in Europe under glass for ornament and outdoors in the tropics throughout the world. Its fragrant white fls. produce the henna or alhenna of the Arabs (Cyprus of the ancients), which is used in Egypt and elsewhere by women to color their nails, and by men to dye their beards. In America it seems to be cult. only in S. Calif. and S. Fla.

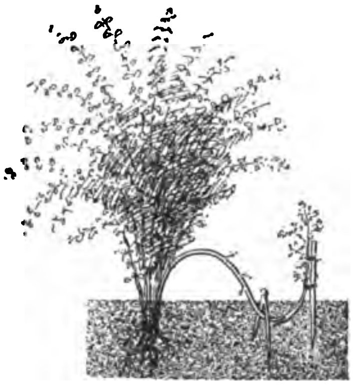
Lawsonia is a genus with perhaps only one species, a glabrous shrub, with branches spiny or not. Important generic characters are: calyx 4-parted: petals 4: stamens 8: capsule globose, 4-celled, rupturing irregularly.

álba, Lam. Henna Plant. Lvs. opposite, oval-lanceolate, entire, short-stalked: fls. panicled. Native to India, the Orient, N. Afr. Naturalized in West Indies.

LAYERING. Figs. 1248–1253. Layering is the process by which a part of a plant stem is made to produce roots while still attached to and nourished by the parent plant, so that it may be able to maintain an independent growth. The tendency, under favorable conditions, to produce roots from the cambium zone of some part of the stem is manifested by many plants, especially in the tropics. It may be noticed in the species of Ficus cultivated in the greenhouse, in Epigæa and *Rhus Toxicodendron* in the woods, in tomato vines in the garden, in grape canes lying on the ground, and frequently in young apple trees when the trunk becomes covered with earth to an unusual depth. With most such plants, rooting by detached parts is easily accomplished, and this being more convenient, layering is generally practiced only with those plants which do not root readily from cuttings.

The mode of root-production is essentially the same in either case. The right conditions as to moisture, temperature, food supply, etc., seem to stimulate the formation of one or more growing points in the cambium zone. The multiplying cells force their way through the bark, and if favorable soil contact is secured, supporting roots are soon developed. The same results may come, sometimes more readily, from or near a callus formed in the effort to heal a cut surface. It is when the food supply is deficient or the cell action is so slow that the detached part would perish before supporting roots could be established, that rooting while the parts are still attached to and nourished by the parent plant need be employed.

The different methods of Layering are simply matters of detail adapted to the varying natures of the plants to be dealt with. Usually branches are selected of rather young wood, which can easily be brought under the soil and which, when rooted, can be removed without damage to the old plant. The most favorable season is generally the spring or time of most rapid cell growth.



1248. A layer notched at the bottom.

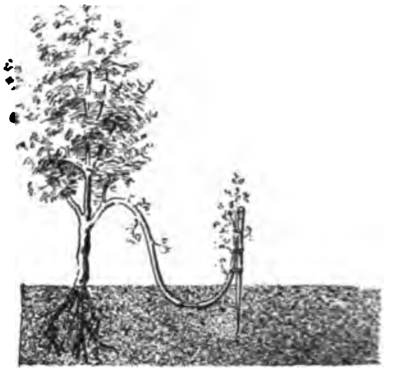
The methods of Layering may be represented in the following diagram:

METHODS OF LAYERING

Trees and Shrubs
- *Bowed branch—*
  - Bark ruptured.
  - Bark ringed.
  - Tongue cut.
  - Tip layered.
- *Mound- or stool-layer.*
- *Potted or aërial layer.*

Vines and Canes
- *Simple layer.*
- *Trench layer.*
- *Serpentine layer.*

As shown in Fig. 1248, a suitable branch is bent to the ground and held in place by a forked pin, so that a portion of it is covered with 2 or 3 inches of rich earth, the end being bent to an upright position and fastened to a stake. The bend and consequent rupture of the bark may be all that is needed to obstruct the movement of food-material and cause the development of roots at this point. If not, a tongue may be cut not deeper than one-third of the thickness of the branch from below upwards and near a bud or node. In Fig. 1249 a layered branch is shown with a ring of bark removed, a good practice with thick, hard-barked species.

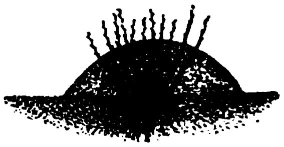


1249. A layer ringed or girdled at the bottom.

For many low-branched shrubs, mound- or stool-layers are prepared (Fig. 1250), as follows: In the spring, head the bush back to a series of stubs, which will produce a large number of vigorous young shoots. By midsummer, in some cases, or the following spring, a mound of earth is thrown around the old stool and the base of the new shoots, and from these latter abundant rooting is secured, so that by the following autumn or spring they may be separated and set in nursery rows.

When a branch cannot be brought to the ground, sometimes the earth is brought to the branch by clasping the halves of a broken or specially made pot around a tongued or girdled branch and filling in earth and sphagnum moss to retain the moisture; or the moss may be held in place by a cone of strong paper (Fig. 1251). It may be necessary to support the pot with a light stand of stakes. Where a moist atmosphere is retained, as in a conservatory, merely a ball of sphagnum bound around the branch with twine will serve an equally good purpose with less trouble. This kind of propagation is known as air-layering, Chinese layering or circumposition.

In the case of vines, a cane may be laid horizontally in a shallow trench, covering a few inches to induce rooting, and leaving a node or two exposed for growth, and so on to the end, as shown by Fig. 1252. After young shoots are well started from the uncovered buds, the earth may be filled in to the level of the dotted line.



1250. Mound- or Stool-Layering.

In Fig. 1253 is shown what is often called the serpentine layer, in which the cane is bent, portions being covered and the intervals left above the ground. It is said that by this means the tendency of the sap to flow to the extremity and there make the strongest growth, is overcome, and even rooting secured the whole length of the cane. This method is often used with quick-growing vines like clematis and wistaria, from which it is possible to secure a succession of layers from the annual growth during spring and early summer.

All of the foregoing operations will be found more readily successful in the more moist situations; more successful in the nearly saturated atmosphere of the southern states, for instance, than in the comparatively dry conditions of the prairie states.

S. C. Mason.

LÀYIA (Thomas Lay, naturalist in the Beechey voyage). *Compósitæ.* About 13 species of California annuals, with yellow or white fls. in spring or early summer. Lvs. chiefly alternate, all entire or some, particularly the lower, with about 2 pairs of linear side lobes above the middle of the leaf. For general culture they are probably inferior to *Madia elegans*, which has a similar habit and is distinguished by the blood-colored spot at the base of the rays. The fls. in Layia are about 1-1½ in. across, and the rays are distinctly 3-toothed. The species described below are diffuse, much-branched and about a foot high. It is probable that for best results they should be started early indoors, and transplanted outdoors in May. Easy to grow.

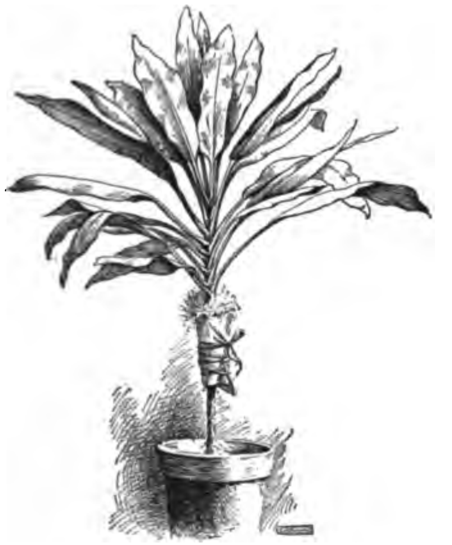
A. *Rays entirely white.*

glandulòsa, Hook. Hispid, sometimes glandular: lvs. 1-1½ in. long, 2-3 lines broad, linear, the upper ones all entire: rays 8-13. B.M. 6856.—Not cult., but desirable.

AA. *Rays yellow, sometimes tipped white*

B. *Plants hairy.*

élegans, Torr. & Gray. All the upper lvs. entire: rays 10-12, yellow, rarely white-tipped: pappus white or whitish, its copious villous hairs much shorter than the awn-shaped bristles, which are long plumose below the middle. This and the next have a few small, scattered, stalked glands which are wanting from the last two. Gn. 31, p. 465.—Procurable from western collectors. Perhaps the best of the genus.


1251. Air-Layering.

platyglóssa, Gray. Some of the upper lvs. pinnatifid: rays light yellow, commonly white-tipped: pappus of stout, awn-like bristles which are upwardly scabrous. B.M. 3719.—Cult. in Eu.

BB. *Plants not hairy or at most minutely pubescent.*

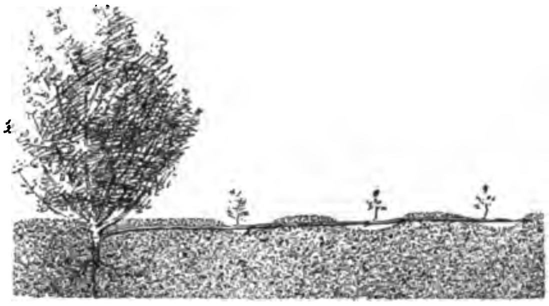
Calliglóssa, Gray. Akenes villous-pubescent or partly glabrate: pappus of 10-18 very unequal and rigid awl-shaped awns. B. R. 22:1850 (erroneously as *Oxyura chrysanthemoides*).

chrysanthemoides, Gray (*Oxyùra chrysanthemoides*, DC.). Akenes wholly glabrous, broader: pappus none. Not B.R. 22: 1850, which is the above. According to Thorburn this is a hardy annual trailer with white fls., blooming in summer and autumn.

LEAD PLANT is *Amorpha canescens.*

LEADWORT. *Plumbago.*

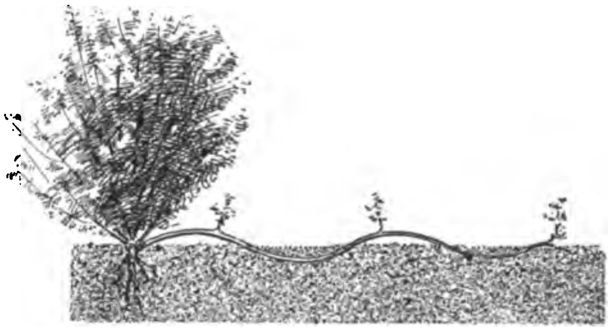
LEATHER FLOWER. *Clematis Viorna.* **L. Jacket.** *Eucalyptus punctata.* **L. Leaf.** *Chamædaphne.* **L. Wood.** *Dirca palustris;* also *Cyrilla.*


1252. A horizontal multiple layer.

LEBIDIERÓPSIS (Greek; resembling Lebidiera, a genus now included in Cleistanthus). *Euphorbiàceæ.* This genus includes a small tree with very hard wood, and of unknown value, introduced from a botanical garden of northern India by Reasoner Bros., Oneco, Fla. Lebidieropsis was reduced by Bentham and Hooker to the rank of a subgenus of Cleistanthus, but in the Flora of British India Hooker says that Lebidieropsis should probably be restored, the seeds being globose, while in Cleistanthus they are always oblong. The seeds also differ in structure. Generic characters of Cleistanthus are: trees or shrubs: lvs. alternate, 2-ranked, entire: fls. small or minute, in axillary clusters and spikes, monœcious; calyx 5-cleft or 4-6-cleft; petals as many, minute; stamens 5; filaments united in a column in the center of the disk: ovary 3-celled.

orbiculàris, Muell., Arg. Lvs. 1½-4 in. long, 1½-3 in. wide, leathery, broadly obovate or elliptic, tip rounded or retuse, glaucous beneath, nerves 5-8 pairs: fls. silky, 3-6 in a cluster; petals fleshy, narrow: seeds 2 lines thick, chestnut-brown, with scanty albumen. Hooker does not recognize the 3 varieties distinguished by Mueller on the shape and hairiness of the lvs.

LÈDUM (*ledon*, ancient Greek name of Cistus). *Ericàceæ.* LABRADOR TEA. Ornamental low evergreen shrubs with alternate, entire, short-petioled lvs., slightly fragrant when bruised, and with handsome white fls. in terminal umbels, appearing in early summer. They are all hardy North, and well adapted for borders of evergreen shrubberies or for planting in swampy situations. They thrive as well in sunny as in partly shaded situations, and prefer a moist, sandy and peaty soil. Transplanting is easy, if the plants are moved with a sufficient ball of earth. Prop. by seeds sown in spring in sandy peat and treated like those of Azalea and Rhododendron, the young plants growing but slowly; increased also by layers and division. Three species in the arctic and cold regions of the northern hemisphere, all found


1253. Serpentine Layering.

in N. America. Allied to Rhododendron, but corolla polypetalous. Fls. rather small, ⅓–½ in. across, long-pedicelled, in terminal, umbel-like racemes; calyx lobes and petals 5, spreading; stamens 5–10: capsule nodding, 5-celled, separating from the base into 5 valves, with many minute seeds. The lvs. contain a volatile oil, with narcotic properties; the lvs. of *L. latifolium* are said to have been used during the war of independence as a substitute for tea, hence the name "Labrador Tea."

palústre, Linn. WILD ROSEMARY. One to 2 ft. high: lvs. linear or linear-oblong, revolute at the margin, dark green and somewhat rugose above, densely ferrugineous-tomentose beneath like the young branches, ½–1½ in. long: stamens 10: capsule ovate. May, June. N. hemisphere, in N. America from Newfoundland to Alaska. L.B.C. 6:560. Var. **dilatàtum**, Gray. Lvs. broader: capsule more oblong. N.W. coast of N. Amer., Japan. Var. **decúmbens**, Ait. With procumbent stems and shorter usually oval lvs.

latifòlium, Ait. (*L. Groenlándicum*, Oeder). One to 3 ft., similar to the former, but lvs. broader, oblong or linear-oblong, 1–2 in. long, tomentum beneath often whitish at first: stamens 5–7: capsule oblong. May, June. Canada to Brit. Col., south to Pa. and Wis. L. B. C. 6:534 and 11:1049 (as *L. canadense*). J. H. III. 31:20 (as *L. palustre*). Gn. 34, p. 31.

L. buxifòlium, Berg.=Leiophyllum buxifolium.—*L. glandulòsum*, Nutt. Shrub, to 6 ft.: lvs. oblong or oval, glabrous, glaucous and glandular beneath: stamens 10. July, Aug. B.C. to Calif. B.M. 7610.

ALFRED REHDER.

LEÈA (James Lee, Scotch nurseryman, 1715–1795). *Leeàceæ.* About 20 species of tropical, oriental small trees or shrubs, some of which are cult. as young plants in warm conservatories for their colored foliage and stately habit. Lvs. alternate, 1–3 times pinnate; lfts. entire or serrate; tendrils none: fls. small or large, red, yellow or green, in cymes; calyx 5-toothed; petals 5, connate at the base and with the tube of stamens: ovary 3–6-celled; cells 1-ovuled: fr. a berry. By Bentham and Hooker this genus was placed in the order Ampelideæ, which others call Vitaceæ. Vitis differs in having the climbing habit, ovary 2-celled; cells 2-ovuled. The first species mentioned seems to be valued particularly for its fls.: the others are foliage plants which are presumably distinct horticulturally, but 2 of them may not be good botanical species, and cannot be distinguished without a knowledge of the flowers.

Leeas are tropical house plants. *L. amabilis* has beautiful, silvery, vine-like foliage. It makes a handsome plant for pillar-posts, and does exceedingly well planted out; but it should be given a season of rest during winter time by a partial drying out, when it will loose most, if not all, its foliage. This practice should be followed in any case. It may also be grown as a trained specimen in pots. Peaty soil is often recommended, but good light loam, with plenty of drainage, does equally well.

A. *Foliage green.*

coccinea, Planch. Lvs. 3-pinnate; lfts. 5 on each main division of the leaf, oblong-lanceolate, dentate, margin recurved: fls. 60 or more in a trichotomous, flat-topped cluster about 3 in. across, scarlet in bud, the 5 spreading lobes of the corolla pink above; stamens yellow, exserted, each fl. about ½ in. across. Burma. B.M. 5299. —It begins to flower when only a foot high, but the main stalk of the clusters is only an inch or so long. Adv. by John Saul, 1893.

AA. *Foliage colored or variegated.*

B. *Lvs. marked bright red; veins white.*

Micholitzii, Hort. Introduced by Sander & Co., 1899, from Guinea, but not distinguished in their description from *L. amabilis*, var. *splendens*, which is probably still cult. in Eu.

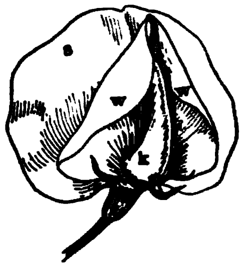
amábilis, Hort. Veitch. Lvs. pinnate; lfts. 5 or 7, lanceolate, acuminate, serrate, upper surface velvety, deep bronzy green, with a broad white stripe; veins white at the bases: young lvs. pale pinkish brown. G.C. II. 17:493. Gn. 21, p. 352. Var. **spléndens**, Lind., is marked with bright red and has a red stem. I.H. 31:518.

BB. *Lvs. flushed bronze; veins rosy.*

sambucina, Willd. (*L. Rœhrsiàna*, Hort. Sander). Lvs. pinnate; lfts. 6½ in. long, 2½ in. wide, oblong, cordate at the base, acuminate, coarsely crenate. India, Malaya, Philippines, trop. Australia. A very variable species. The above synonymy is the judgment of M. T. Masters in G.C. III. 23:245. F.E. 10:554. A.F. 13:1284. Gng. 6:278.

T. D. HATFIELD and W. M.

LEEK (*Allium Porrum*), a flat-leaved, bulbous, hardy biennial, is probably a native of the Mediterranean region, where, particularly in Egypt, it has been used for culinary and medicinal purposes since prehistoric time. All parts of the plant possess an offensive, pungent odor and acrid taste due to an essential oil characteristic of its close relative, the onion. In medicine, the bulb, like the onion, is used as a renal stimulant. The blanched stems and leaves are much employed in continental cookery as a flavoring for soups, stews, etc., boiled and served like asparagus, and in the raw state. Except in the larger cities and among our foreign population, the Leek is little used in America. The seed should be sown in a well-prepared, light, deep, rich, moist loam in a nursery bed or coldframe. The site should be open, the subsoil dry. When six or eight weeks old, or about 5 inches tall, the young plants should be set 9 inches asunder, in drills 3 to 6 inches deep and 18 inches apart. Shortening both roots and stems is often advised. As the plants grow, the soil should be drawn loosely round the stems and lower leaves to insure blanching. When blanched Leeks are not desired, the plants may be cultivated like onions; indeed, except for earthing up, the cultural methods employed for these two crops are identical. Leeks are marketed in bunches like young onions and, for winter use, are stored like celery. As a second crop to follow early cabbage, spinach, etc., they are in general favor with market-gardeners. In soups and stews the rank odor disappears, leaving a mild and agreeable flavor.



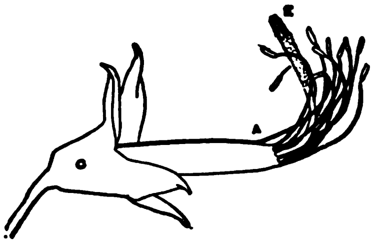
1254. A papilionaceous flower—Sweet Pea.
Showing the banner, standard or vexillum at *s*; the wings at *w*; the keel at *k*.

M. G. KAINS.

Leek, though of the onion family, and also a biennial, is differently treated and used. The object in its cultivation is to develop the leaves in such a manner that they become numerous; the flower-stem does not appear before the second year, hence the necessity of growing it to full size the first year.

Sow the seed in March in a seed-bed (with slight bottom heat), in drills 2 or 3 inches apart; when large enough, thin out to stand 1 inch apart in the row, as they may attain the thickness of a fair-sized straw. In May or early June the seedlings are transplanted in the open ground; they are then cut half-way down and should also be set deep, so they will begin blanching when they attain a fair size. The soil best suited is a rich, moist, light loam; prior to the transplanting it should be well prepared with well-rotted stable manure, if possible. The plants are generally set in drills 12 to 15 inches apart, and 6 to 9 inches apart in the drills. They should be well cultivated, and when growing freely should be earthed up slightly with the hand cultivator or hand-hoe. Some of the successful gardeners still cultivate them on the celery-trenching system; by this means they can be watered more thoroughly and will attain a much larger size; also can be conveniently left in the trench with slight protection, and taken therefrom for winter use. Care must be taken not to cover too early, as they decay easily, beginning at the end of the foliage; this destroys their appearance. The hardier kinds are used for this purpose and will blanch yellow down to the so-called stem, which is white to the root. Leeks planted out in May are ready for use in September; the sowings can be made earlier and later to suit the time of maturing, and can be sown in August and September in coldframes and wintered over with slight protection, then transplanted to the open ground in April. The varieties best known to American gardeners are London Flag, Large Musselburgh or Scotch Flag, Giant Carentan, and Large Rouen.

J. Otto Thilow.



1255. Essential organs of a Sweet Pea flower. Calyx at C; tenth stamen at A; stigma at E.

LEGUMES. The popular name given to a vast and important family of plants, of which pea, bean, clover, vetch, etc., are common representatives. The order is generally known as the pulse family, or *Leguminosæ*. It contains nearly 450 genera, comprising over 7,000 species, and in economic importance ranks second only to the grasses (*Gramineæ*). The species of this family are distributed over the entire earth. By far the greater number are herbs and half-shrubby plants, but in the warmer regions of the earth they attain the dimensions of forest trees. Numerous species are widely cultivated as agricultural crops. Among these, beans and peas are important food-plants, while clover, vetches, peas, melilot, alfalfa, lucerne, cow-peas, etc., are valuable forage crops, cover-crops, and green manures. Many of the exotic species are of commercial importance. The arboreal forms furnish structural timber and cabinet woods. Many also furnish dye-stuffs, rubber, balsams, oils, etc., and some are cultivated for ornamental purposes.

1256. Pod of a Legume —Bean.

In respect to the character of the flowers, the family is divided into three subfamilies. In the large subdivision to which the ornamental species of Mimosa and Acacia belong, the flowers are small and regular and often clustered in spherical or oblong heads. The stamens are free or united into a tube and much exerted. In the second subfamily the flowers are usually irregular, with the upper petal folded inside of the others in the bud. The coffee-tree, honey locust, and the large genus Cassia belong in this subdivision. Most of the native species of Legumes, and all those cultivated as farm crops, belong to the vast subfamily *Papilionaceæ*. In these the flower is of the papilionaceous type, or pea type (Fig. 1254). The upper larger petal, called the banner, *s*, is exterior and folded over the others in the bud. The two lateral ones, situated below the banner, are the wings, *w*, *w*, while the lower pair, which are sometimes united, form the keel, *k*. The keel encloses the stamens and pistil, the latter being often bent at right angles to the ovary, or coiled. The stamens are either free or they form a tubular sheath surrounding the ovary. Often the upper one alone is free, leaving a slit along the upper side of the sheath (Fig. 1255). These flowers are often dependent on insects for pollination, a fact which is of great importance in raising clover seed.

1257. An indehiscent leguminous pod—Daubentonia.

The fruit of the Leguminosæ is a pod or Legume, as in the bean (Fig. 1256). As a rule, the pods are one-loculed, and have the seeds arranged in rows. In some tribes they become several-celled by partitions which arise between the seeds. These pods become constricted at the partitions, and at maturity separate into short joints (see Fig. 694, Vol. 1). The valves of the pods are generally papery or leathery, and open at maturity, often by a sudden snapping of the valves, which scatters the seeds. In other tribes, however, the pods are indehiscent, or do not split at maturity (Fig. 1257).

The roots of Legumes have numerous small tubercles scattered throughout the root-systems. Fig. 1258. These are caused by and infested with minute organisms, to which the name bacteroids has been applied. The bacteroids are always present, and probably multiply to some extent in soils where Legumes have been grown. They are very minute bodies, which are either rod-like in form or branched in the form of a Y or a T. The infection of the plants has been observed to take place through the root-hairs. Within the plant the bacteroids assume a new and peculiar form. They grow out into a branched and flexuous thread, which is enlarged and nodulose at places. At the point of infection the root-cells are stimulated to growth, producing the nodules characteristic of Legumes. The threads permeate the entire tubercle. The old threads finally disorganise, and it is believed that their protein substances are absorbed by the host.

It has been shown, first in 1886 by experiments conducted by Hellriegel and Wilfarth and later by numerous other investigators, that when Legumes are grown in sterilized sand, which contains no trace of nitrogen, they soon die of nitrogen-hunger, and no tubercles are formed on their roots. If, however, a very small quantity of soil extract or of bacteroids, grown from root-tubercles, is added to the sand, the plants assume new vigor and grow to maturity. Tubercles are formed on the roots, and the plants are found to contain more nitrogen than was present in the seed. By such experiments it is shown that Legumes can acquire free nitrogen through the agency of the bacteroids. The physiological process by which this is done is still obscure.

Some species of Legumes can be innoculated by bacteroids from other species, but others seem to be dependent upon their own specific organism. The organisms are spread in the soil only by mechanical agencies, such as working the soil, moving water, wind, etc. If the soil is rich in nitrogen, leguminous plants can develop, like all others, without the aid of tubercles.

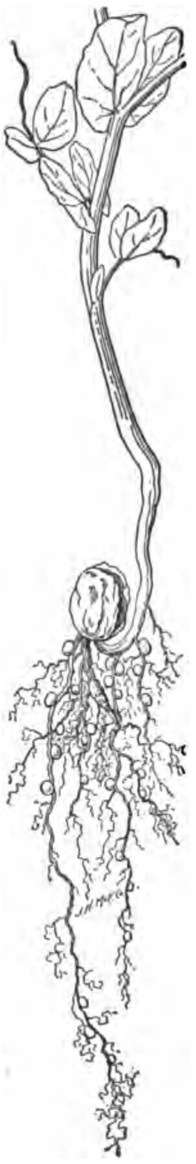
Recently pure cultures of bacteroids have been offered in the market as Nitragin, to be used for the purpose of innoculating soils deficient in micro-organisms. Although several experimenters claim success with this substance, its practical application to agriculture remains yet to be demonstrated. The substance sold as Alinit, and said to enable grasses to acquire free nitrogen, is merely a pure culture of a very common bacterium present in all decaying matter.

HEINRICH HASSELBRING.

LEIOPHÝLLUM (from *leios*, smooth and *phyllon;* referring to the smooth foliage). Syn., *Dendrium*, *Ammyrsine*. *Ericàceæ*. SAND MYRTLE. Evergreen hardy densely branched shrub, sometimes procumbent, with small, glabrous, opposite or alternate crowded lvs. and white or light pink small fls. in terminal many-fld. umbels, appearing profusely late in spring. It resembles in appearance somewhat the Dwarf Box, and is well adapted for borders of evergreen shrubberies and also for rockeries. It thrives best in a peaty or very sandy, loamy soil and as well in a sunny as in a partly shaded position. Prop. by seeds sown in pans and placed in a cool frame or by layers put down in fall. One species in E. N. Amer. from N. J. to Fla. Allied to Ledum. Lvs. entire: fls. in terminal, umbelliform corymbs; sepals and petals 5; stamens 10: fr. a 2–5-celled dehiscent many-seeded capsule.

buxifòlium, Ell. (*Lèdum buxifòlium*, Berg.). Dense, leafy bush, to 3 ft. high: lvs. short-petioled, thick, oval or obovate, about ⅛ in. long: fls. white, pinkish outside, about one-fifth in. across, on slender pedicels; petals elliptic, almost twice as long as sepals. April–June. Pine barrens and mountains, N. J. to Fla. B.M. 6752. Gn. 42, p. 559. G.W.F.A. 49. B.R. 7:531 (as Ammyrsine). L.B.C. 1:52 (as Ledum). Var. **prostràtum**, Gray. Forming dense depressed tufts: lvs. usually oval, and deep green. High mountains of Carolina.

ALFRED REHDER.



1258. Nodules on the roots of a young plant of garden pea. Natural size.

LÉMNA (Greek, *limne;* a large pool of standing water). *Lemnàceæ*. DUCKWEED. DUCKSMEAT. Duckweeds are common upon stagnant pools, often covering the water with a blanket of green. They are easily gathered for schoolroom and home aquaria, and may be procured from specialists in aquatics and native plants. Ducks and carp eat these plants greedily. One of the common Duckweeds is shown 6 times its natural size in Fig. 1259. Duckweeds are small floating plants, without any distinct stems, a whole plant commonly consisting of one leaf and one unbranched root which has no vascular tissue. These lvs. are called fronds by the botanist largely because lvs. do not ordinarily emit roots. The plants grow separately, or cohere by their edges in 2's or 3's, and multiply by similar fronds, which grow out of the edges of the old ones something like buds. The flowers are minute and appear on the edge of the frond. They consist of a pistil and generally 2 stamens which are inclosed in a sheath. which the botanists have determined is a spathe by reason of the place where it is borne and by homology with related plants. *L. minor* is said to flower more frequently than any other northern species. Details of its flower are shown in Fig. 1260, where there seem to be 4 anthers, but there are only 2, each bearing 2 locules. Some botanists consider the 2 stamens as 2 fls. and the pistil a third flower. Duckweeds are perennial plants. In the autumn they fall to the bottom of the ditch or pond, but rise again in the spring. and increase in size. The allied genus Wolffia contains the smallest flowering plants in the vegetable kingdom. There are about 11 species of Duckweeds, widely scattered. *L. polyrhiza* is commonly known in American botanies as *Spirodela polyrhiza*, but Spirodela is considered by Bentham and Hooker a subgenus of Lemna. The common Duckweed occasionally infests the small lily ponds (artificial ones), where it is a pest. The simple remedy is to flush the pond and see that common goldfish or carp are in sufficient numbers to clear off the remainder.

A. *Veins 7–11: roots several.*

polyrhiza, Linn. (*Spirodèla polyrhìza*, Schleid.). Also spelled *polyrrhiza*. Fronds broadly ovate or orbicular, attaining 3 or 4 lines diam. B.B. 1:365.

AA. *Veins 1–5: root solitary.*

B. *Fronds oblong, 6 lines long, 3 lines wide.*

trisúlca, Linn. Fronds much thinner than in the next, narrow and minutely toothed at one end, thicker and taslk-like at the other, usually with 2 young ones growing from opposite sides near the base. B.B. 1:366. V. 3:200.

BB. *Fronds broadly ovate or orbicular, 2 lines long.*

minor, Linn. Figs. 1259–60. Fronds usually cohering in 3's or 4's, rather thick, not minutely toothed. B.B. 1:366. V. 3:200.

WM. TRICKER and W. M.

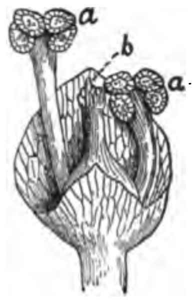
LEMON culture in Florida was assuming an important share of horticultural work previous to the cold winter of 1894–5, but since then attention has been more largely given to hardier fruits. The growing of Lemon trees is beginning again in lower Florida, in sections free from killing frosts, and although soil conditions are rather unfavorable to the cultivation of citrous trees, owing to the rocky or poor character of the ground, there is evidence of interest and some practical results from the experimental plantations. There remained after the killing freezes some isolated orchards of Lemons in southern Florida, which have since entirely recovered and have borne full crops of fruit for two or three years.

The pecuniary reward to a careful Lemon grower is large, provided he has suitable soil and a situation removed from killing frosts, and, although profits from other citrous fruits may be temporarily larger, Lemons are constantly in demand, and the reward is correspondingly certain. Orchards are usually set with budded trees, about 20 by 25 feet apart. The young trees after setting are advantageously mulched with grass or other litter, which holds moisture for the unestablished roots, and gradually rots, affording humus. The stocks used are sour orange and rough Lemon principally, but other stock may be used, and the Lemon may also be raised from cuttings in the same manner that citrons are grown. The remarks as to the use of *Citrus trifoliata* as a stock for limes will apply also in this case (see *Lime*),

The cultivation is the same as for orange trees: shallow plowing early in spring, followed by thorough harrowing once or twice each month until the summer rainy season has well set in. After this time the grass which naturally springs up is allowed to grow at will until autumn, when it is mowed for convenience in picking fruit and getting about the orchard. Many growers perceive advantage in raising soil-enriching plants in the orchard and so, instead of allowing native grasses to grow, sow seeds of various forage plants, as beggar-weed (see *Desmodium*), cow-peas, velvet beans, etc., part of which growth is harvested for hay, the rest left to add fertility to the soil, and is later plowed under. In late autumn most growers apply fertilizer, usually composed of sulfate of potash, sulfate of ammonia and bone-black, which is broadcasted at the rate of 800 to 1,500 pounds per acre. This fertilizer is not wasted by the action of the sun, and is either left on the surface to be washed in by rain or is mixed in the soil by harrow or turning-plow. Fertilizing is also done in the early summer, and occasionally a third application is made before ripening of the fruit, but the rule is, two applications per year of about the same amount each.

E. N. REASONER.

1259. Duckweeds, Lemna minor.



1260. Floral details of Lemna minor.
aa, stamens; *b*, pistil.

Lemon in California.—Though Lemons have been grown in California for half a century, it is only during the last decade that the culture has risen to considerable commercial importance. This fact is shown by the latest statistical data, which indicates about a quarter of a million bearing trees and about a million non-bearing trees as comprising the aggregate of Lemon planting in this state. The early product consisted of seedlings which were of excessive size, with juice of low acid content and rind of marked bitterness. The closest attention of Lemon-growers was given about twenty years ago, and for some time afterwards, to the testing of the best seedlings and the varieties brought from the Mediterranean region, to secure acceptable size, thinness of rind and freedom from bitterness, with high percentage of citric acid in the juice. The result was that a few such varieties were found and they were demonstrated to be equal in these characteristics to the imported fruit from Sicily. Then, for the first time, California growers were able to compete with the imported fruit, and the planting of Lemons began upon a large scale. The local markets were first supplied, overland shipments were undertaken, and the fruit was found to be acceptable east of the Rocky mountains and the undertaking to displace the Mediterranean fruit at all points in the United States began. This effort was greatly advanced by the protective tariff, which counterbalanced the advantages which foreign producers had previously enjoyed in cheaper labor and in less cost of transportation. Shipments of about 1,200 car-loads of Lemons a year to the eastern markets show the success which California growers have attained in competition with the imported fruit.

Local adaptations of climatic and soil conditions to the growth of the Lemon have required long and close study and experimentation. The Lemon is less hardy than the orange, and will suffer seriously with degrees of frost which the orange will endure. Almost frostless situations are, therefore, most promising. The Lemon will reach perfection in a region where the summer heat may be slightly less than required to develop satisfactory sweetness in the orange. These desiderata of very light frost and somewhat lower summer temperature are found to coincide in places most open to ocean influences in southern California. Roughly speaking then, the Lemon region is on or near the coast and the orange region in interior valleys. Differentiation in planting these two fruits has proceeded along these lines quite largely, though it is still true that in certain places most excellent Lemons are grown at interior points and most excellent oranges near the coast. The orange has proved to be, however, rather more easily grown and prepared for market than the Lemon, and on the whole, more profitable, perhaps; so that these facts are to be properly included when an effort is made to account for the disposition of those owning Lemon orchards in the interior to work them over to the orange.

A light warm loam is best suited to the growth of the Lemon, while the orange root seems to be adapted to a range of heavier soils. This was of more moment when the practice was to grow the Lemon on its own roots, either from cuttings or by budding on seedling Lemon stock. But the production of a Lemon tree of less riotous growth and fruit of less average size and, withal, a healthier and more satisfactory tree, was found to be attained by using the orange seedling as a stock for the Lemon tree, and this is the universal practice at the present time. Propagation is by the ordinary process of budding on a seedling root two or three years old. Distances of planting in the orchard differ somewhat according to the judgment of growers, but about 100 trees to the acre is the average.

Pruning the Lemon has been a vexed problem with the growers for years. The tree is naturally of rangy growth, running out long leaders which afterwards assume a pendent form and are tossed about in the wind, to the detriment of both tree and fruit, which is apt to come at the ends of the long, pliant shoots. Thus an unpruned Lemon orchard becomes almost impenetrable for necessary orchard work. This is in marked contrast to the growth of the orange, which is more compact and symmetrical, and needs but slight regulation after a good form is secured in the young tree. Regular shortening-in of the branches of the Lemon is therefore necessary, followed by thinning of the new shoots, so that the tree shall not make too many bearing twigs and become too dense in the center. In that way the fruit can be kept within easy reach, and the branches stiff and strong to carry it.

Ample irrigation and frequent cultivation to prevent evaporation afterwards are essential to thrift and bearing of the Lemon in California. Neglected trees lose their leaves and prematurely ripen fruit lacking in juice.

Scores of varieties have enjoyed fleeting popularity in California and now not more than six are largely grown; viz., Villa Franca, Lisbon, Eureka, Genoa, Messina and Bonnie Brae. Of these, the first three constitute probably four-fifths of the crop.

The preparation of the Lemon for marketing has been a matter of discussion and experiment for years. The bulk of the crop ripens in the winter: the time to sell Lemons is in the summer. The Lemon ripened on the tree has very poor keeping quality. Both for meeting the market demand and to secure a fruit which will endure shipping, Lemons need storage for a considerable time. Proper storage, or curing, as it is generally called, results in thinning and toughening the rind so that it has a pliable character, a silky finish and is not easily bruised in handling. Very costly curing houses have sometimes been found defective in not readily disposing of the products of evaporation from the fresh fruit. At present, simpler constructions, consisting in thoroughly ventilated inner apartments for the fruit, with outer walls and double roof to protect the interior against wide temperature changes in the outer air, are giving very satisfactory results. The fruit needs freedom from extremes of temperature, abundant ventilation and yet no intrusion of wind or air currents and the absence of light. When these are secured, the fruit ripens slowly, assumes a beautiful, characteristic color and is then good for long keeping or distant shipment. It is essential to secure uniform size, and this is done by picking without regard to ripeness as soon as a fruit reaches a certain size. The result is that the fruit is picked before any sign of coloring appears. The standard is 2¼ inches in diameter, as measured with an iron ring which the picker carries. The diameter decreases one-eighth of an inch during curing. Late-ripening fruit, for quick sale, may be allowed to get a little larger, but no fruit should be above 2⅝ inches in diameter. All fruit must be cut and not plucked from the trees, and until the final packing for shipment, should be handled in shallow trays or boxes, piled with air spaces between them so that the air may circulate and remove the exhalations.

E. J. WICKSON.

LEMON VERBENA is *Lippia*.

LEMON VINE is *Pereskia*.

LEMÒNIA. See *Ravenia*.

LENS (ancient Latin name of the Lentil). *Leguminòsæ*. This genus includes the Lentil, *Lens esculenta*, one of the oldest and still one of the most important food-plants for man, especially in the warmer parts of the Old World and the Orient. It is a much-branched tufted annual 1–1½ feet high. The leaves have numerous leaflets and end in a tendril. The flowers are small, white or pale blue, axillary and borne in pairs. The pods are short and broad, very flat, and contain 2 flat seeds which are rounded in outline and convex on both sides. The lens of the astronomer and physicist was named because it was shaped like one of these seeds. Some varieties have gray seeds, others red. Esau sold his birthright to Jacob for a mess of red pottage made of Lentils. Lentils are used chiefly for soups and stews. They are a coarser and cheaper food than fresh peas and beans, and about as palatable as split peas. Lentils rank amongst the most nutritious of all vegetables, as they contain about 26 per cent caseine, 35 per cent of starch and only 14 per cent of water. Lentils are also of the easiest culture, but the seeds are often destroyed by a weevil. The seed is generally sown in drills in March. The heaviest crops are produced on rather dry, sandy soils. The plants need no special care between seedtime and harvest. The seeds keep better in the pods than after being threshed out. Some of the varieties are the Puy Green, Small Winter and Small March. The genus Lens is placed by Bentham & Hooker between the vetch and sweet pea, (Vicia and Lathyrus). In Lens and Vicia the wings of the flower adhere to the keel, while in Lathyrus they are free or only slightly adherent. Lens has 2 ovules; Vicia usually many.

LENTIL. See *Lens*.

LEONÒTIS (Greek, *lion's ear*, which the flowers are supposed to resemble). *Labiàtæ*. LION'S EAR. LION'S TAIL. This includes a tender shrub, with scarlet-orange, gaping fls., cult. outdoors in S. Fla. and S. Calif. As a bedding plant it is little grown north of Washington, D. C., and it is far outclassed in popularity by the Scarlet Sage, which gives an equally vivid mass of red in the northern autumn. The Lion's Ear differs from the Scarlet Sage in having conspicuously hairy, almost plush-like fls. These are 2 in. long, as many as 18 in a whorl, and 3 or 4 whorls open successively on each branch. The fls. are oddly gaping, the upper lip very long and uncut, the lower very short and 3-cut. In the North, cuttings should be started in early spring, the young plants transplanted to the open in May and thereafter frequently pinched to make a symmetrical instead of a straggling bush, and if the plants do not flower before frost, they can be cut back, lifted and brought into a cool greenhouse to flower in November or December. A southern enthusiast says that they are as easy to cultivate as a geranium.

Franceschi writes that the plant seldom seeds in S California, and must be propagated from cuttings, which, if taken from hardened wood, do not root as readily as many other labiates. The plants are much improved by cutting back every year or so.

Leonotis has about a dozen species, chiefly south African. Herbs or shrubs: lvs. dentate, the floral ones alike or narrower and more sessile: fls. scarlet or yellow; calyx tubular, 10-nerved, obliquely 8–10-toothed; stamens 4, didynamous.

Leonùrus, R. Br. Shrubby, 3–6 ft. high: lvs. 2 in long, oblong-lanceolate, obtuse, coarsely serrate, narrowed at the base, slightly tomentose beneath: floral ones like the rest; corollas more than thrice as long as the calyx. S. Afr. B.M. 478 (as *Phlomis Leonurus*). R.H. 1857, p. 548. Gn. 53, p. 460. G.C. II. 19:186.

W. M.

LEONTÌCE (Greek, *lion's foot;* referring to the shape of the leaf). *Berberidàceæ*. LION'S LEAF. About 7 species of hardy herbaceous perennials, chiefly Asian, of low growth and distinct appearance. Three kinds are advertised by the Dutch bulb growers, but perhaps one of them belongs to Bongardia. Leontice is distinguished from the highly interesting and rare group mentioned under Epimedium by having 6–9 sepals (which are the showy parts), and 6 petals reduced to small nectaries. Like Bongardia, it has 6 stamens and a bladdery capsule. These plants have a turnip-shaped corm about 2 in. thick, and bear yellow fls. in early spring. Bongardia has only one species, which is described in the supplementary list of the present article.

A. *Lvs. twice ternately cut.*

Leontopétalum, Linn. Lfts. ovate or obovate, rarely subcordate: panicle large, dense, leafy. Italy and the Orient.—Root used in the Holyland against epilepsy.

AA. *Lvs. digitately cut.*

B. *Raceme dense, conical.*

Álberti, Regel. Stems several, stout, each giving off 2 subradical lvs. which are undeveloped at flowering time: lvs. finally on stalks 4–5 in. long, digitately 5-parted; lfts. pale green, glaucous, elliptic; nerves prominent and parallel beneath: scape 6–8 in. high, robust: raceme as many as 18-fld.: fls. nearly 1 in. across, ochre-yellow, streaked reddish brown on back; petals shorter than the stamens. Turkestan. B. M. 6900. Gt. 1881:1057.

BB. *Raceme loose, oblong.*

Altàica, Pall. According to Index Kewensis, this is a synonym of *Bongardia Rauwolfii*, but the following description, taken from the plant figured as *L. Altaica*. in B. M. 3245, is very distinct from that figured as *Bongardia Rauwolfii* in B. M. 6244. Lvs. not from the root, digitately cut, only one leaf on each flower stem, the leaf having 3 primary divisions, each of which is petioled and has 5 lfts., 2 of which are smaller than the rest; lfts. elliptical: inflorescence a raceme, bearing large, more or less roundish leafy bracts: fls. mostly erect, having 6 showy, oblong, not overlapping, entire parts supposed to be sepals, the petals small, yellow, erect, shorter than the anthers.

Bongárdia Raùwolfii, C. A. Mey. Lvs. all from the root, pinnate; lfts. 3–8 pairs, or some of the lfts. in whorls of 3–4, wedge-shaped, 3-fid, with a conspicuous triangular crimson mark at the base of each: inflorescence a panicle, bearing minute, linear bracts: fls. drooping, having 6 showy, wedge-shaped, crenate parts, 3 of which should possibly be considered petals, and the other 3 inner sepals, since there are 3 small, greenish lobes outside which are like an ordinary calyx, and should, perhaps, be called the outer calyx. B.M. 6244. F.C. 3:98. B. 1:50.

W. M.

LEONTOPÒDIUM (Greek, *lion's foot*). *Compósitæ.* The Edelweiss is perhaps the one flower most sought by tourists in the Alps. It is an emblem of purity, and the name means "noble white." It is a low plant, 4–12 in. high, densely covered with a whitish wool, the attractive portion being the flat, star-like cluster of woolly floral leaves surrounding the true fls., which are small, inconspicuous and yellow. The general impression seems to be that Edelweiss cannot be cult. in America. In 1900, however, it is being extensively advertised as a pot-plant, and it has long been cult. in rock gardens. J. B. Keller writes, "It can be grown to perfection in elevated position of the rockery, in rather light soil and with full exposure to sun. It also succeeds in an ordinary hardy border where the plants can be kept moderately dry in winter." Dreer advises that the seed be sown early in spring in shallow pans of sandy soil and leaf-mold and kept cool and moist. E. J. Canning sows seeds of Edelweiss in 4-in. pots in the greenhouse in Feb., pricking off as soon as large enough to handle, and finally transferring them to the rock garden, where they flower well the second year; but after that they are inclined to die out.

1261. Edelweiss—Leontopodium alpinum (× ¼).

To establish a colony of Edelweiss an English writer (Gn. 52, p. 146) advises that a few stray seedlings be firmly planted in a narrow chink of rock so placed that a deep fissure of gritty or sandy loam may be assured for the roots to ramble in. Plants in pots may be grown and flowered when the collar is tightly wedged between some pieces of stone or old mortar. The plant is best propagated by seeds, as division is not always successful.

Leontopodium has about 6 widely scattered species of perennial herbs, all tufted and woolly, with ascending or erect stems which are unbranched except at the very top: stem-lvs. alternate, entire: heads small, crowded into dense cymes surrounded by a sort of leafy involucre. Edelweiss is still catalogued as a Gnaphalium, but in that genus the style is 2-cut, while in Leontopodium it is uncut. Leontopodium is more nearly allied to our common weed, the "Pearly Everlasting" (*Anaphalis margaritacea*), which lacks the dense cluster of star-like floral leaves, but in the opinion of the writer has as much beauty as the Edelweiss.

alpìnum, Cass. (*Gnaphàlium Leontopòdium*, Linn.). Fig. 1261. Lvs. lanceolate, floral ones oblong: fl.-heads 7–9 in a cluster: involucral scales woolly at base, blackish at apex. B.M. 1958. Gn. 29, p. 529 and 52, p. 146.

LEOPARD'S BANE. *Doronicum.*

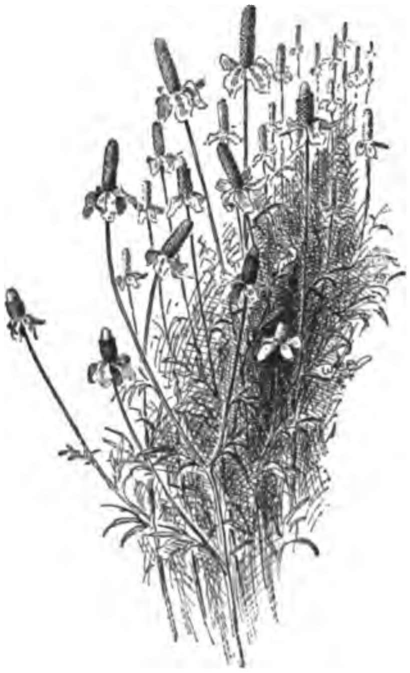
LEOPARD FLOWER is *Belemcanda.*

LÈPACHYS (Greek, *a thick scale;* probably referring to the thickened upper part of the bracts of the receptacle). *Compósitæ.* This includes a fine prairie wild-flower, *L. columnaris*, for which, unfortunately, there is no common name. It grows 2–3 ft. high, has elegantly cut foliage, and bears fls. something like a Brown-eyed Susan, but the disk is finally cylindrical and more than an inch high, with 6 or 7 oval, reflexed rays hanging from the base. In a fine specimen these rays are 1½ in. long and nearly 1 in. broad. There are 5 inches or more of naked wiry stem between foliage and flower. Typically, the rays are yellow, but perhaps the most attractive form is var. *pulcherrima*, which has a large brown or brown-purple area toward the base of each ray. Like the majority of our native western fls. that are cult. in the eastern states, the plants have reached our gardens from European cultivators. Meehan says it is perfectly hardy in our northern borders, but the English do not regard it as entirely safe without some winter protection. Moreover, it is one of the easiest herbaceous perennials to raise from seed, flowering the first year, and it is chiefly treated in the Old World as an annual bedding plant, the seeds being known to the trade as *Obeliscaria pulcherrima.* For bedding, the seeds are sown in early spring in a hotbed, the seedlings pricked off into boxes, hardened off, and finally transplanted to the open, only slight care being necessary to obtain compact bushes about 2 ft. high. Under such circumstances the plants flower from June to September, and the season may be prolonged by a sowing in the open. This plant deserves trial in our northern borders, where seed can probably be thinly sown in the open, where the plants are to stand, with a fair chance of autumnal bloom the same year. The fls. last well in water and should be cut with long stems to get the benefit of the delicately-cut foliage.

Lepachys contains 4 species of herbs, all American, 3 perennial. Lvs. alternate, pinnately divided or parted: disks at first grayish, their corollas yellowish, becoming tawny: chaffy bracts commonly marked with an intermarginal purple line or spot, containing volatile oil or resin. Monographed in Gray's "Synoptical Flora." For generic distinctions, see *Rudbeckia.*

A. *Rays oval, scarcely as long as the disk at its longest.*

columnàris, Torr. & Gray. Fig. 1262. Branching from the base, 1–2 ft. high in the wild, often 3 ft. in cult.: stem-lvs. with 5–9 divisions, which are oblong to linear in outline and sometimes 2–3-cleft: fls. solitary, terminating the branches; rays yellow; style-tips short, obtuse. Prairies. B.M. 1601. Mn. 1:65. G.W.F.A. 8.



1262. Lepachys columnaris (× 1-5).

Var. **pulchérrima**, Torr. & Gray (*Obeliscària pulchérrima*, DC.), differs only in having the rays partly or wholly brown-purple. The plants in the trade are mostly margined with yellow or have about half of each color. Gn. 51:1104. R.H. 1854:421. Var. **totus-purpùreus**, Hort. D. M. Andrews, is "a variety with dark orange-brown rays, almost black."

AA. *Rays oblong-lanceolate, very much longer than the disk.*

pinnàta, Torr. & Gray. Slender, 3–5 ft. high: lvs. with 3–7 lfts., which are lanceolate, sparsely serrate, sometimes lobed, the uppermost run together: rays yellow, often 2 in. or more long. Western N. Y. to Ia., south to La. B.M. 2310.

J. H. COWEN.

LEPÍDIUM (from Greek for *little scale;* alluding to the small flat pods). *Cruciferæ.* CRESS. PEPPERGRASS. Perhaps 100 species of small herbs (sometimes undershrubs) in many parts of the world, with very small white fls. There are about 20 native species, mostly western, and several introduced weedy species. The foliage and pods have an aromatic-peppery flavor. The foliage of some species is used as salad, and the pods are sometimes fed to tame birds (whence the name "Canary grass"). There are no species of much ornamental value.

sativum, Linn. GARDEN CRESS. Annual, 1–2 ft., glaucous when in flower and fruit, glabrous: fls. small and inconspicuous, in an elongating raceme: pods nearly circular, bifid at the apex, winged: lvs. exceedingly various, but usually the radical ones pinnately divided and subdivided, the central cauline ones 2–3-cleft nearly to the base and the segments entire or toothed, the uppermost simple and entire. W. Asia, but widely disseminated as a cult. plant, and sparingly run wild in the northern part of the U. S. and Canada.—Under cultivation the foliage varies immensely. The curled sorts have lvs. as finely cut as curled parsley. On Australian Cress, which is a golden-lvd. form, there are sometimes on the same plant broad-spatulate, ragged-edged lvs., cut lvs., and simple linear lvs. For culture, see *Cress.*

Other Lepidiums are sometimes eaten, but are not in the trade and are of little importance. One of these is the common *L. Virgínicum*, Linn., wild in the U. S., and known as Pepper-grass. Others are the Chilean *L. Chiléнse*, Kunze, and the Oceanic *L. piscídium*, Forst. f.

L. H. B.

LEPTACTÌNA (Greek, *graceful rays;* referring to the star-like aspect of the flower). Also written *Leptactinia*. *Rubiàceæ* This includes a shrub from western tropical Africa which should rank among the finest tall hothouse shrubs in cultivation that have large white flowers. The fls. have a slender tube, 4 in. long, and 5 narrow spreading lobes, each 5½ in. long and recurved for one-third of their length. As many as 4 fls. are borne at the top of each branch, in the axils of the highest pair of lvs. The plant might be compared to a giant-flowered, loose-clustered Ixora. It is not yet advertised in America, but seems worthy of a trial in some of our best conservatories.

The genus contains 6 species, all tropical African shrubs, important generic characters being the large calyx lobes, very long corolla tube, 5 included stamens, style branches free or connate, large, lax stipules, and clustered inflorescence.

Mánnii, Hook. Branching shrub, 6 ft. high: lvs. 5½ in. long, 2½ in. wide and larger in proportion, oval, wavy-margined, obtuse, with globose green bodies between the insertions of the lvs., which are stipules: calyx tube 3 lines long, lobes 1 in. or more long, leafy; corolla silky within, lobes lanceolate; stamens 5, included: style hairy above, 2-branched. B.M. 7367.

LEPTOSÌPHON. Now referred to *Gilia.*

LEPTOSPÉRMUM (Greek, *slender seed*). *Myrtàceæ.* This genus includes some Australian shrubs, which are cult. outdoors in S. Calif., and under glass in the North only by a few persons who are expert in the culture of heaths and other hardwood Cape and Australian plants. They have great numbers of small white, yellowish or pinkish fls. about ½ in. across, with 5 petals, which are roundish and clawed. Franceschi reports that they stand drought well in California. The genus has about 20 species, chiefly Australian, and has not been monographed since 1866, in vol. 3 of Flora Australiensis. Shrubs or small trees: lvs. small, rigid, entire, alternate, nerveless or 1–3-nerved: fls. white, sessile, solitary or 2–3 at the ends of short branchlets or in the axils of the lvs.: fls. usually white; stamens numerous. The young shoots are often silky.

Leptospermum bullatum (see *L. scoparium* below) is an exceptionally good pot-plant for those who can grow heaths. It is better than *L. lævigatum.* Cuttings taken from well-ripened wood in the fall or from young growth in summer root freely under the treatment given Erica. For a potting, use two parts leaf-mold and one of sand. Plunge the pots outside during the summer in the full sunlight. The plants make a straggling growth, unless trimmed into shape. By fall they will be covered with buds, but it is impossible to force them into bloom for Christmas. Keep the plants in a cool house with Ericas or Azaleas until the latter part of February or March, and then give them a little more heat, say 55° to 60°. The plants will soon be a mass of white flowers. *L. bullatum* does not grow rapidly, but, like Epacris, as it grows older it makes fine specimens. It has tough foliage, stands much hard usage, and when in bloom attracts plant-buyers. It deserves greater popularity.

A. *Ovary usually 10-celled.*

lævigàtum, F. Muell. Tall shrub, attaining 20–30 ft., glabrous and somewhat glaucous: lvs. varying from obovate oblong to oblong-cuneate or narrow-oblong, obtuse, mostly 6–9 lines long, but sometimes 12 or more, 3-nerved: calyx glabrous: capsule slightly protruding above the calyx tube. B.M. 1304 (as *Fabricia lævigata*). G.C. II. 25:816; III. 9:45.

AA. *Ovary usually 5-celled.*

B. *Calyx tube glabrous.*

C. *Lvs. flat or with recurved margins, obtuse or scarcely pointed (except in the large variety).*

flavéscens, Smith. Lvs. varying from narrow-oblong or linear-lanceolate to broadly oblong or even obovate. usually less than 6 lines long, attaining 9 lines in the largest forms. Var. **commùne**, Benth and Muell. Lvs. narrow, 6–9 lines long: fls. middle-sized. B. M. 2695. Var. **obovàtum**, F. Muell. Lvs. broadly obovate to obovate-oblong, under 6 lines long. Cult. in Europe under glass. Var. **grandiflòrum**, Benth. & Muell. Lvs. rather larger: fls. larger than in any other variety. L.B.C. 6:514.

CC. *Lvs. flat or concave, sharp-pointed, narrow or small.*

scopàrium, Forst. Attaining 10–12 ft.: lvs. ovate to linear-lanceolate or linear, mostly under 6 lines long. Otherwise, almost exactly as in flavescens. B.M. 3419. *L. juniperinum*, a narrow-leaved form, is considered synonymous by the botanists, but is kept distinct in the trade, as also is *L. bullàtum*, Hort., which is perhaps the only Leptospermum cult. in the North. J.H. III. 30:435. *L. scoparium*, var. **grandiflòrum**, Hort., Gn. 51:1120, is one of the most desirable forms. It is said to be of relatively easy culture, with compact habit, the branches spreading in all directions.—Excellent plants for the amateur, but very slow-growing.

BB. *Calyx tube more or less densely clothed with silky or woolly hairs.*

lanigerum, Smith. Lvs. varying from obovate-oblong to elliptic or narrow-oblong, normally 6 lines long. A form with lvs. narrower, 6–12 lines long, and large fls., is pictured in B. M. 1810. L. B. C. 8:701. I. H. 32:570. G. C. II. 12:427. Gn. 19:266, and 27, p. 145.—Extremely variable. Long cult. abroad, but not adv. in America.

H. D. DARLINGTON and W. M.

LEPTÓSYNE (Greek, *slenderness*). *Compósitæ.* This includes some yellow-fld. composites, with much-divided foliage like Cosmos. They are 7 species of herbs and subshrubs, all from California except *L. Arizonica.* They are the representatives of Coreopsis on the western side of the continent, but have mostly pistillate rays and always a ring on the tube of the disk-fls. In the North these plants are mostly treated as half-hardy annuals. None of them has anything like the popularity of either Cosmos or *Calliopsis elegans*. The commonest species is *L. maritima*, but *L. Stillmani* promises to outrank it, though it is not yet advertised in America. *L. Stillmani* is said to bear fls. 1⅛ in. across, for 5 or 6 weeks. Its seed germinates quickly and can be sown outdoors. Sandy soil and a sunny position is advised. It is said to bloom in four to five weeks after sowing. *L. maritima* should be started indoors, transplanted in May, and can be brought into flower by July. Two distinct plants are passing in the trade as *L. maritima*, one of which is *L. calliopsidea*, and is considered an inferior plant by some. The seeds of the two plants are easily distinguished. Genus monographed 1886, in Gray's "Synoptical Flora."

A. *Rays obovate.*

B. *Seeds having long, soft, villous hairs.*

calliopsidea, Gray (*Agarista calliopsídea*, DC. *Coreópsis calliopsídea*, Bol.). This is the plant figured in R.H. 1873:330, erroneously as *L. maritima*. Annual, 1–2 ft. high: fls. 3 in. across; rays fewer, shorter and broader than in *L. maritima*, 1¼ in. long, ¾–1 in. wide.

BB. *Seeds having short, rigid bristles.*

Doùglasii, DC. Annual, 9–12 in. high: lvs. 1–3-times parted: ring of the disk-fls. distinctly bearded. Int. by Orcutt, 1891.

BBB. *Seeds not hairy.*

Stillmanni, Gray. Stouter than *L. Douglasii*: ring of the disk-fls. beardless. Gn. 52, p. 461. G.C. III. 22:333. R.B. 23, p. 275. Gt. 46, p. 612. S.H. 2:44. Int. 1898, by Benary.

AA. *Rays oblong.*

B. *Stems low, from a thick base.*

maritima, Gray. Perennial: lvs. 2-pinnate: fls. 3⅛ in. across, borne at the ends of branches on peduncles 9–12 in. long; rays 16–20, 1⅛ in. long; disk 1 in. across: seeds not hairy. B.M. 6241. Gn. 49:1061. Not R.H. 1873:330, which is really *L. calliopsidea*.—Makes a good bog plant.

BB. *Stems 2–8 ft. high, 1–5 in. thick.*

gigantèa, Kellogg. Differs in being leafy at the top only, the others being leafy at the base: lvs. 2–3-pinnate: fls. smaller than in *L. maritima*, borne on short corymbose peduncles; disk ⅛ in. across: seeds not hairy. Cult. in S. Calif. Gt. 44, p. 592.—Franceschi says the fls. are sweet-scented. W.M.

LEPTOTÆNIA dissécta and **multifida** were advertised in 1881 by Edward Gillett, of Southwick, Mass., for Californian collectors, but it is doubtful if any plants of these species are cult. in gardens. They are presumably inferior in height and hardiness to Ferula. For descriptions, see Coulter and Rose's Revision of North American Umbelliferæ, 1888.

LEPTÒTES. See *Tetramicra.*

LESPEDÈZA (D. Lespedez was a Spanish governor of Florida, who aided the botanist Michaux). *Leguminòsæ.* BUSH CLOVER. Between 30 and 40 perennial herbs and shrubs in N. Amer., Asia and Australia, with small (often inconspicuous), pea-shaped fls. in racemes or heads: lvs. pinnately 3-foliolate or rarely 1-foliolate, the lfts. entire and wanting stipels: calyx lobes nearly equal, sometimes subulate; anthers usually 9 and 1: pod short and 1-seeded (and in this differing from Desmodium, which has jointed pods). In some of the Lespedezas there are two kinds of fls.,—petal-bearing and mostly sterile, apetalous and mostly fertile. There are a number of native Lespedezas, some of which are offered by dealers in native plants, but they are not very showy and are most in place in native borders and in amateur collections. Two or three of the oriental species are now becoming popular. *L. striata* is the Japan Clover of the South, and is a valuable forage and green-manure plant. *L. bicolor* is a low shrub, with small violet-purple fls., hardy in New England, but little known in cult. The most important ornamental members of the genus thus far introduced are *L. Sieboldi* and *L. Japonica*, which are hardy herbs sending up many strong, wiry shoots each year, and blooming profusely in September and October. Their late bloom is very desirable. All Lespedezas are of the easiest culture wherever hardy. Usually increased by division of the clumps. *L. Sieboldi* is readily propagated by greenwood cuttings under glass. Monogr. by Maximowicz in Act. Hort. Petrop. ii. (1873).

A. *Occidental or native Lespedezas: of upright or erect habit, not showy: stipules and flower-bracts minute, subulate.*

These species are not in general commerce, but are offered by dealers in native plants. They thrive in light, dry soils. Because of the grayish or brownish color of the foliage, they are sometimes useful in landscape-gardening work. Hardy, and of easiest culture. Perennial.

B. *Fls. whitish or yellowish, all complete.*

hirta, Ell. Erect, 2–4 ft. tall, silky-pubescent: petioles shorter than the lvs.: lfts. nearly orbicular: fls. in oblong or cylindrical heads which are on peduncles which usually exceed the lvs. Dry soils, New England to Fla. and W. Mn. 6:181.

capitàta, Michx. Much like the last, but lfts. narrow-oblong or oval, and the fl.-heads dense and short-peduncled. Range of the above.

1263. Lespedeza bicolor. (× ⅙.)

BB. *Fls. purple or violet, or some of them apetalous.*

C. *Peduncles slender.*

violàcea, Pers. Two to 3 ft., only slightly pubescent: lfts. oval or elliptic: fls. small, in a loose cluster which is on a stalk usually longer than the lvs. Range of above.

Nùttallii, Darl. Two to 3 ft., hairy-pubescent: lfts. oval, oblong or nearly orbicular: fl.-clusters dense or even capitate, the stalk mostly exceeding the lvs. Range of above.

CC. *Peduncles nearly or quite wanting.*

Stùvei, Nutt. Mostly unbranched, 2–4 ft., velvety-pubescent: petioles very short: lfts. oblong to nearly orbicular: fls. in nearly sessile, axillary clusters or heads. New York, south and west.

frutéscens, Britt. (*L. Stùvei*, var. *intermèdia*, Wats.). Less pubescent or almost glabrous: petioles mostly longer: lfts. oval to elliptic: clusters very short-stalked. New Eng., south and west.

AA. *Oriental Lespedeza, grown for forage in the South: of trailing habit: stipules and fl.-bracts conspicuous.*

striàta, Hook. & Arn. JAPAN CLOVER. HOOPKOOP. Annual, somewhat pubescent, decumbent or erect, slender: lvs. small and very numerous, the lfts. oblong or obovate, and the petioles very short: fls. small, pink or purple, in axillary clusters. China and Japan.—Said to have been introduced accidentally into S. Car. in 1849, but probably in the country much before that time. It is now extensively naturalized south of the Ohio river, growing on nearly all kinds of land. On light lands it makes dense mats, but on heavy lands grows 18–24 in. high. It is a good pasture-and hay-plant, and is useful for plowing under as a green manure. It thrives on land which is indifferently prepared. For hay, seed is sown early in spring, at the rate of ½ bushel per acre. It often yields 2 tons of hay to the acre. For pasturage in the South, it is sometimes sown with oats in the fall.

AAA. *Oriental Lespedezas, grown as ornamental plants for the fls.: erect: stipules and fl.-bracts small: perennials.*

bicolor, Turcz. Fig. 1263. Shrub, with slender branches, becoming 6–10 ft. tall, slender and graceful, glabrous: lvs. on thin wiry stalks, mostly longer than the glabrous blades; lfts. oval to round-obovate, rounded at the apex, the terminal one 1–2 in. long: fls. small, purple, in simple or compound racemes, which surpass the lvs.: pod ¼ in. long, somewhat pubescent. Japan. —Hardy as far north as Boston, blooming in July and seeding freely. A good slender shrub for adding variety to the border. A white-fld. variety is advertised.

Sièboldi, Miq. (*Desmòdium pendulifldòrum*, Oudem. *L. racemòsa*, Dipp. *L. formòsa*, Koehne). Fig. 1264. Herb, throwing up strong, wiry shoots each year from the crown: stems angled, reddish or brown, hairy (at least above): lvs. dull above and light-colored and hairy beneath, the petiole usually somewhat shorter than the blade; lfts. elliptic-oblong-pointed: fls. twice larger than in the last (nearly ½ in. long), rose-purple, drooping in very numerous long racemes, which at the top of the plant are panicled: pod nearly or quite ½ in. long, pubescent. Japan. G.F. 5:115. Gng. 1:23. R.H. 1873:210. J.H. III. 30:15. G. C. II. 20:749. F.S. 18:1888. B.M. 6602 and Mn. 7, p. 69 (as *L. bicolor*).—Blooms in September, and hardy in central New England. A very desirable late-blooming plant, making a large specimen with age. Does not often seed in the North.

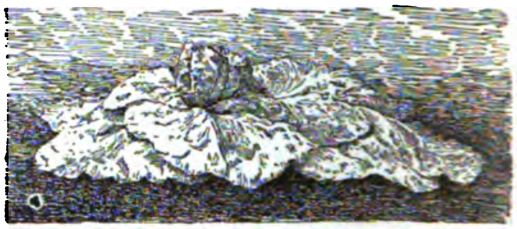
1264. Lespedeza Sieboldi. (× ½.)

Japónica (*Desmòdium Japónicum*, Hort., not Miq.). Very like the last, but blooms a week or two later, has very numerous pure white fls., much lighter colored herbage, usually nearly glabrous lvs. and stems, the lfts. broader and less pointed.—Hardy as the last, and seems to seed more freely in the North. Perhaps a botanical variety of *L. Sieboldi*, but distinct for horticultural purposes.

Other Japanese and Chinese Lespedezas may be expected to appear in the trade. See Franchet, R.H. 1890, pp. 225–227, for an account of W. China ornamental species, with picture of *L. Delavayi*. L. H. B.

LETTSÒMIA is a genus of the Convolvulus family. About 26 species of tropical oriental climbers. An unknown species was advertised from S. Florida in 1889 and is still procurable. Reasoner and others think well of it.

LETTUCE (see *Lactuca*) is the most popular of salad vegetables. Plate XVIII. It is a quick-growing annual, delighting in cool atmosphere and open, loose soil. As an outdoor crop, it thrives best in spring. Special care is needed to grow it in the hot summers of America, although heat-resisting varieties have been developed. Of late years, the forcing of Lettuce under glass has come to be a large industry. The most serious trouble in forcing Lettuce is the rot, due to a species of botrytis. The leaves become soft and fall, leaving only the core of the plant erect (Fig. 1265). This trouble may be prevented by growing in loose soil, by keeping the surface of the soil and of the plant as dry as possible, and by avoiding a too warm and too moist atmosphere. Sub-irrigation (see *Irrigation*) is to be advised for Lettuce forcing. Of varieties, there are two general types,—the cabbage or heading sorts (Fig. 1266), and the loose sorts (Fig. 1267). The latter are more used because more easily grown, but the former are considered to be the finer.



1265. Lettuce plant collapsed with the rot.

In 1885, Goff reduced the kinds of Lettuce to 87 varieties (4th Rep. N. Y. Exp. Sta.), throwing them into three general groups: (1) leaves roundish or but slightly oblong, spreading rather than upright; (2) leaves oblong, tending to grow upright; (3) leaves pinnately lobed. These categories were divided into subtribes on minor leaf-characters. In 1889 (Annals Hort.) 119 names of Lettuces were catalogued by North American seedsmen. Lettuce has been in cultivation for over 2,000 years. L. H. B.

Lettuce Out-of-Doors.—While Lettuce seems never more enjoyable than when it comes from the greenhouse during the colder parts of the year, yet it is acceptable for salad purposes and is in good demand the entire year. In open ground, at the North, we may have it in all its perfection from June until snow flies again in the fall. Usually it is much less of a knack, however, to have it in the earlier part of the season and up to August, than in the torrid weather of August and early fall. For early market we start the plants in the greenhouse during February, and prick them out in flats or sunken thumb-pots filled with rich, fibrous loam, and after thoroughly hardening them by exposure for a week or more in a coldframe, we take the plants up, with a chunk of soil, and plant them out in very rich, well-prepared loam outdoors, just as soon as the weather will permit. Tennisball and its various strains and selections, Boston Market, etc., are good for this purpose. The rows may be made a foot apart, and the plants set 6 or 8 inches apart in the rows. We want neat solid heads, even if not as large or heavy as some of the heads we can easily produce later on from summer varieties, and we wish to get them as early in the season as possible in order to be able to put them on the market when prices are still high. Light applications of nitrate of soda, either broadcast over the patch at the time of setting the plants, or along the rows very soon after, seldom fail to assist in hastening early growth and to increase the size of the heads. This is a "trick of the trade" well worth practicing. The free use of the wheel-hoe keeps the soil loose and the crop free from weeds, and also hastens it to early market condition.

1266. Heading Lettuce.

At the time of setting the first plants in open ground, we also sow a patch with the garden drill, using seed

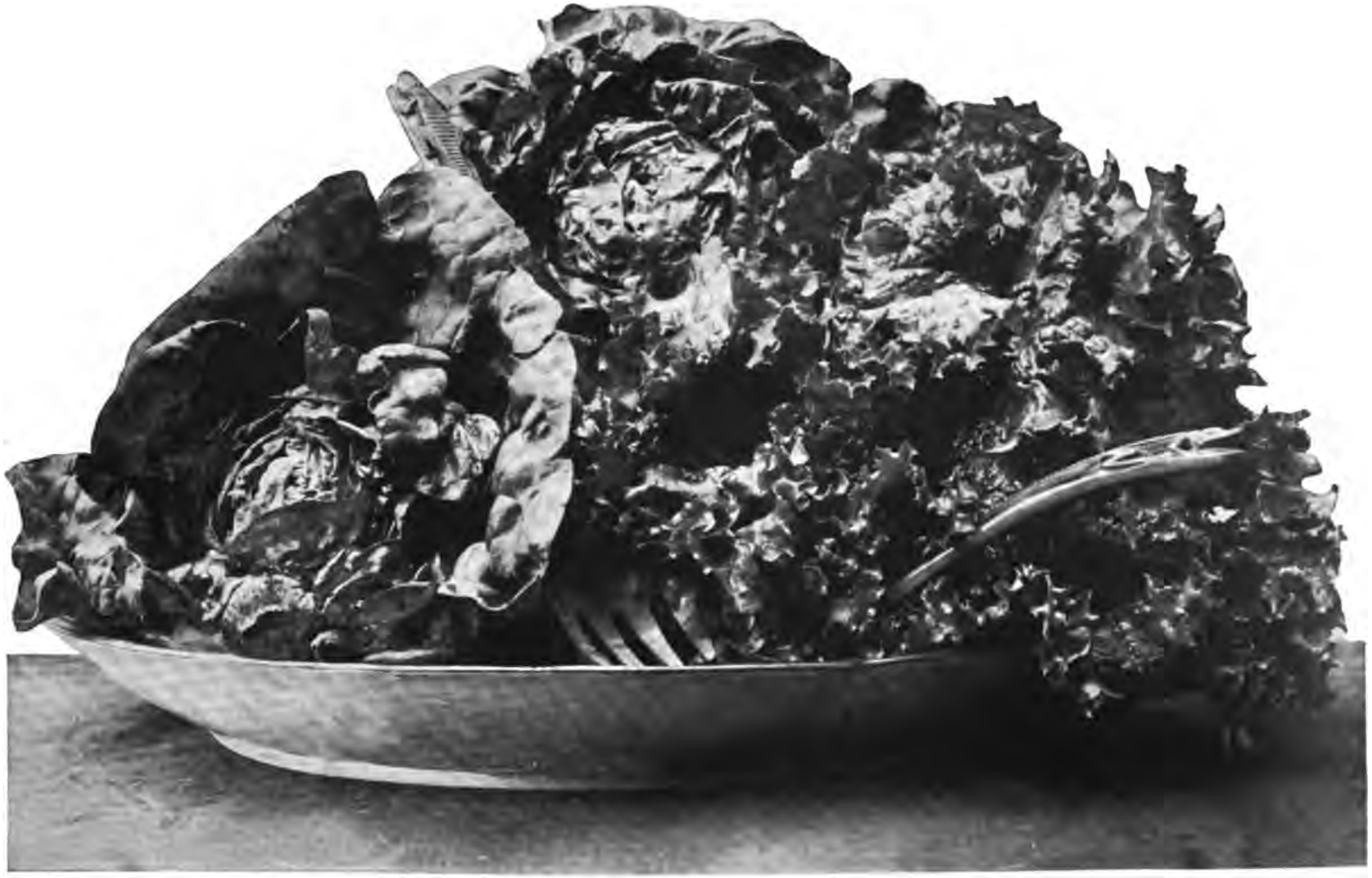


Plate XVIII. Lettuce, showing the heading and loose-leaved types.

sparingly and covering it lightly, say one-half inch deep, although in good soil the seed will come up readily even if placed an inch or so below the level of the surface. The varieties catalogued by seedsmen as suitable for summer culture are almost endless, and most of them are good enough. Among the standard sorts we have the Hanson, Deacon, Simpson, Salamander, Stubborn Seeder, several Butter Lettuces, etc. Because of our hot, dry seasons, the Cos Lettuces are less popular in this country than in Europe. The heads should be tied up and blanched, for the best results. The plants of drill-sown Lettuces should be thinned early. For home use we leave them at first only a few inches apart, so that they have just room enough to form little heads. Every other plant may then be taken out and used for the home table. These little heads are delicious. The remaining heads are left to attain full size and are then used for the table or for market. If grown for market only, the plants are thinned to stand not less than 5 or 6 inches apart from the start. In due time every other plant can be taken up for market, while the ones remaining have a chance to grow to largest size afterward. From early spring until along in August we sow a few rows of these summer Lettuces every two weeks or so, and thus try to provide a continuous supply of good heads. The demand may drop off for a few days, or even weeks, but it is sure to revive. If we can manage to have good Lettuce late in the fall it will seldom go begging for customers.

1267. Curling, or Grand Rapids Lettuce.

Sometimes we may wish to raise seed of a sort that suits our purposes. All we have to do is to leave some of the plants in the rows, until the larger part of the seeds on a plant have matured. The plant is then cut off near the ground and exposed on a sheet to sun and air to dry. The seeds are then to be thrashed out and cleaned. T. GREINER.

LETTUCE FOR THE VILLAGE GARDEN AND CITY YARD.—The value of Lettuce for the table depends largely upon its being fresh. A very small area may be made to produce an abundant supply for an ordinary-sized family. The plant is quite healthy and hardy, when young enduring a considerable frost without injury. It has few insect enemies and the requisites for its successful culture are few and easily understood. On this account it can be grown with greater satisfaction and profit on a village lot, or even in a city back yard, than can most of our garden vegetables. To produce it of the best quality under these conditions, as early in the spring as the ground is at all dry and the grass begins to start, a bit of ground should be well dressed with fine manure, putting on from one-half a bushel to one bushel to the square yard, and then well spading up, working in the manure and making the bed as fine and smooth as possible. Make a mark about one inch deep, drop in the seed at the rate of from 25 to 50 seeds to the foot, and cover with from one-fourth to one-half an inch of fine soil pressed down with the hoe or hand. From two feet to two yards of such row for each member of the family should furnish an abundance for the time that the product of a single planting is usable, and if more than one row is planted they should be about two feet apart. In from 15 to 20 days the young plants should be thinned out leaving 8 to 10 to the foot, and at the same time a second row, to give a succession, should be planted. About 20 days later the first row should be re-thinned, leaving plants from 6 to 12 inches apart according to the size of the variety, and a third row planted. A fourth planting may be made, but Lettuce planted as late as the time of the ripening of strawberries is not likely to do very well unless protected from the sun and heat. A supply of fine fall Lettuce may be secured if, in August or early September, we re-manure and spade the ground which was occupied by the first crop, and make a trench some 6 or 8 inches deep and fill this with water. When this has soaked away, refill, and repeat this from one to six times, according to the dryness, of the soil. Fill this trench with fine, moist, not *wet* soil, in which make a mark and sow the seed as in the spring. Cover the row with a foot-wide board, and about three days later put some bricks under so as to hold the board about two inches above the soil. As soon as the plants are well up turn the bricks so as to hold the board about four inches up, and take it off altogether about five o'clock in the afternoon, leaving it off until eight or nine in the morning. On cloudy days give more exposure, as the plants develop until the shade is entirely dispensed with. Some of the finest Lettuce the writer has ever seen was grown in a city yard by this method. W. W. TRACY.

LETTUCE FORCING.—This vegetable is one of the principal money crops of the market-gardener in winter. It is grown in hotbeds and hothouses. The old way is to raise it in hotbeds, but since the experiments of growing in houses have been so successful it is grown mostly in them.

For the first early crop to be grown in beds or houses, the seed is sown in the seedhouse about August 20, in the latitude of Boston. By this means, the Lettuce will be brought into market the latter part of October or the first of November, after the frost has spoiled the outdoor crop; and thus it often brings very good prices. The sowing is made in a bed in the house prepared for the purpose with sterilized soil, so that there will be no fear of a rusty root or mildew on the plants. The soil should be 10 inches deep, well moistened and beat up very fine, with no manure or fertilizer. For every ounce of seed, prepare a space 6 feet square, raking off the bed as smooth as possible. Sow the seed and then sprinkle the bed with water. Then sift on one-fourth of an inch of either sterilized or clean subsoil, preferably the latter. In about four days the plantlets will appear. Three weeks from sowing, the plants will be ready for transplanting. This should be done at the proper time, that is, before the plants become too large. Prepare the soil the same as for the seed-bed. If 3 inches of the sterilized soil, or some new soil that no Lettuce has been grown in, can be had, it will be sufficient. Transplant the Lettuce 4 inches apart in sufficient quantity to set out the prepared space. In three or four weeks these plants will be large enough to again transplant into the bed or house intended for them. Sterilizing is done in a box 5 x 4 feet and 3 feet deep, with several punctured steam pipes in the bottom. The soil should heated to 200°.

In preparing the bed for the last transplanting, the soil should be well wet before working and then let stand until the water has all drained off, which will be in about twenty-four hours. Now put in stable manure, worked fine with the first heat out of it, which is secured by piling and overhauling twice a week for two or three weeks before using. Apply this prepared manure about 3 inches deep and dig into the soil to a depth of 12 to 15 inches. Rake off and mark with the marker 8 inches apart. If the soil is new no sterilization is needed, but if old would prefer about 2 inches of the top sterilized. This is done to prevent the mildew and disease that often comes from old, worn-out soil.

If the bed is properly prepared it will need no watering. If the plants are large, they may need to be sprinkled immediately after setting the last time. No more water is required until they begin to mature. Many think that the crop requires constant watering, but that is wrong, because the roots will not go down if the top is kept constantly wet, and a better crop will be obtained if not watered until it begins to mature or to head.

The kind of Lettuce intended in the above remarks is the head variety, called in many sections the Boston Lettuce. This crop should be ready to begin to pull in six or seven weeks from time of last transplanting. According to the previous statements, it has taken thirteen weeks from seed to produce a crop. This is starting in September or October. Earlier than this the time will be one or two weeks less. It is customary to pull over the bed once and take out the best ones, and then give the remainder a good wetting. In about one week those left will be fit to pull clean. After the first transplanting to 4 inches, it is the surest way to smoke the house three nights in succession, once the second week and once the third week. This is done to keep the plants free from disease or from the green-fly or louse. If it is desired to follow with a second crop of Lettuce on the same bed, the plants must be ready for the second crop when the first is taken off, and thus lose no time of the house.

In hotbeds much the same course is pursued as in the house; sometimes one will succeed better than the other. For midwinter the houses are the better, and for late spring the beds.

The best way of heating the beds is by the use of hot stable manure placed in the bottom of the bed, and about 8 inches of loam on top. Ten inches of manure, hot, will hold for two crops of Lettuce. The first crop will need a little special fertilizer. The second crop will require about 3 inches of stable manure prepared as for the houses. The beds are prepared in the fall and covered with coarse manure or hay until wanted. The beds, after setting, are covered with straw mats or shutters at night when the temperature is below freezing, and ventilated by day when it is above 60°.

The heat is supplied to the houses by steam and the temperature controlled by ventilation. The proper temperature for the growing crop is 40° at night and 70° by day.

For continuous crops through the season, sow every week enough seed to give the plants required. One ounce should produce 5,000 plants. This sowing is continued until February 1, which is the time to sow the seed for the crop to be set out in the field. These plants are grown in hotbeds and hardened off before they are set out; that is, they are transplanted from seed-bed to 4 inches apart in hotbeds, and are then taken up and transplanted to the field. This is a very different variety of Lettuce. It will not head in the houses, while the variety grown in the houses will not grow in the field.

A great improvement has been made in the varieties of Lettuce. The variety grown twenty years ago called White Seed Tennisball was a very fine Lettuce and would pack 6 dozen to the barrel-box or 10 dozen to the barrel, but the improved variety of to-day will fill 3 dozen to the barrel-box and 5 to 6 dozen to the barrel. The new variety is called the New Hothouse Lettuce, and will grow in beds just as well as in the house.

Experiments made with the electric light have been very successful. It not only hastens the time of growing, but also improves the size and quality of the head. The writer estimates that the light increases the size and quality 10 per cent and hastens the time of growth 15 per cent. This is by the use of arc lights over the houses by night. This could not be practiced on hotbeds, because they are covered by night. Between the first of November and the first of March the days are very short and the nights very long, so that the electric light increases the length of the day, and when applied it has the same effect as the longer days of spring have upon the growth of crops.

The Lettuce, when prepared for market, is pulled, then washed, and for the Boston market is put in boxes of 3 dozen each and sold at wholesale by the box. The smaller heads are packed 4 dozen in each box and are usually sold per box for about one-half the 3-dozen size. When packing for other markets, as New York, Philadelphia, Washington or Chicago, it is packed in cases that will hold a barrel. These cases have a partition in the center, so that the Lettuce when packed will not all fall to one end should the cases be roughly handled. The expense of sending a case from Boston to New York is 25 cts., to Philadelphia 50 cts., and to Chicago 75 cts.

The crop from the South has affected our sales very much in the midwinter, but the climate seems to have changed in that locality so that it is in our favor, for of late years they have cold weather there two or three times each season, thus giving us the market. Our Lettuce is far superior to theirs and of a different variety. They have named theirs the Big Boston. It will be seen that the name of Boston is very popular in the Lettuce market. This inferior Lettuce coming from the South is packed in baskets.

There is a disease of Lettuce called by some a "burn," but this is a misnomer. It is a disease coming more from a diseased root or a cold soil, because it develops most when there is but very little sun, and least when there is most sun; and if the plant is examined there will be found a diseased root. Here the benefit of the new or sterilized soil is very apparent. The use of sterilized soil is of much more benefit than the electric light, because if the plant is diseased no light will cure it and no crop can be successful with diseased plants. Preparing the soil by wetting thoroughly before transplanting is one of the great secrets in successful growing of Lettuce, and heating the water to a high temperature is also very beneficial. It lessens disease.

The price at which Lettuce can be grown at a profit is a question very difficult to answer, but by the figures made by some of the members of the Boston Market-Gardeners' Association it was decided that for midwinter crop the Lettuce must be sold at 50 cts. per dozen to return any profit to the grower. W. W. RAWSON.

LEUCADÉNDRON (Greek, *white tree*). *Proteàceæ.* This genus includes the celebrated Silver Tree of the Cape of Good Hope (see Fig. 1268), which has a striking and unique habit. Its lvs. are densely covered with white silky hairs. This tree grows wild only on Table Mountain. In the first quarter of the century it was considered of great importance for firewood. It is said to grow poorly away from the Cape, except in S. Calif., where it generally does well outdoors. It is also rarely cult. in the East in tubs, being protected in a cool greenhouse during winter and placed on the lawn in summer. The Silver Tree attains 30 ft. at the Cape. The trees are practically male and female, the fls. being diœcious by abortion. The female tree is cult., being prop. by seeds imported from the Cape. The young seedlings are very difficult to raise. There is no monograph of this genus since Meisner's in DC.Prod. Vol. 14, 1856, but the genus will be reviewed in a forthcoming volume of Flora Capensis.

1268. Silver tree. Leucadendron argenteum.

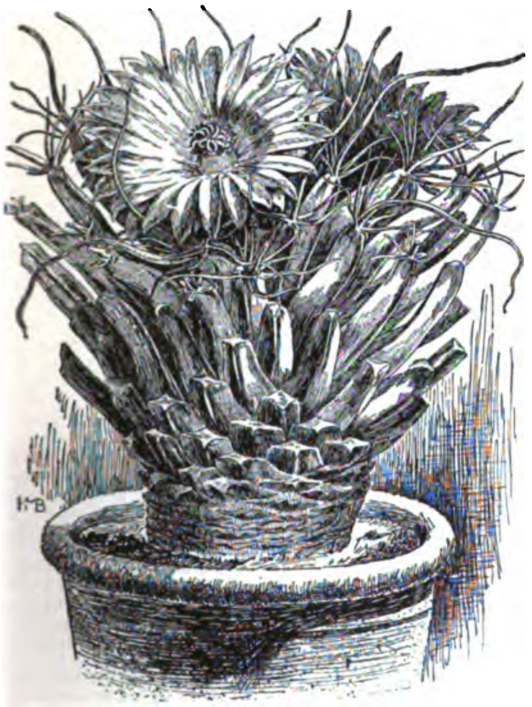
argénteum, R.Br. Fig. 1268. Branches densely leafy: lvs. sessile, 3–6 in. long, ½–1 in. wide, callous and blackish at the apex, lanceolate, acute, silvery white and silky: involucres spreading, longer than the globular head of fls.: nut ventricose, turgid, wingless, the whole style and calyx persisting with it, obovate. B.R. 12:979. V. 5:282, 283.

LEUCÆ̀NA (probably from Greek, *leukos*, white; referring to the fls.). *Leguminòsæ.* This includes a tree known in S. Fla. as the White Popinac, a rapid grower, with acacia-like foliage and whitish fls. It is also cult. in S. Calif. The genus has about 9 species, found in

Mexico, Guatemala, Peru, and Pacific islands, but *L. glauca* is found in the tropics of both worlds. It grows wild in the West Indies and in western Texas. The trees and shrubs of this genus have the habit of Acacia, but belong to the Mimosa tribe, which is characterized by stamens 10 or less. Generic characters are: calyx 5-dentate: stamens 10, not glandular: pod broadly linear, stalked, flat-compressed, chartaceous, 2-valved: seeds compressed. *Acacia trichodes* is *L. trichodes*, Benth., but it is not in the trade.

glaùca, Benth. (*Acàcia frondòsa*, Willd. *A. glaùca*, Moench). Spineless: branches and petioles powdery: pinnæ 4–8-paired; lfts. 10–20-paired, oblong linear, glaucous below: pod 5–6 in. long.

LEUCHTENBÉRGIA (after Prince Leuchtenberg). *Cactàceæ*. Agave Cactus. Stems in age forming a trunk 2 in. or more in diam., by the shedding of the lower tubercles: tubercles triangular-acuminate, spreading, 2–4 in. long, ½–¾ in. wide, with twisted papery spines: fls. funnelform, widely expanded, borne near the apex of young tubercles: fr. gray, ovate-elliptical, 1 in. long, covered with scales and crowned by the persistent flower: seeds dark brown, minutely tuberculate. Only 1 species, closely related to Echinocactus, but of remarkably different form. The plant is readily grown in the manner of Echinocactus and Mamillaria.



1269. Leuchtenbergia principis (× ½).
(Adapted from Botanical Magazine.)

principis, Hook. & Fisch. Fig. 1269. Radial spines 6–8, the central one usually solitary, longer, sometimes 8 in. long: fls. yellow. B.M. 4393. A.G. 11:464.

Katharine Brandegee.

LEUCOCRÌNUM (Greek, *white lily*). *Liliàceæ*. Sand Lily of Colorado. A hardy bulbous plant growing a few inches high, with narrow foliage and clusters of pure white, fragrant fls. borne just above the ground in early spring. The fls. are funnel-shaped, having a slender tube 2–4 in. long, the greater portion of which is below the surface of the soil, and 6 lobes, each ¾–1½ in. long. They are borne in clusters of 4–many fls., and maintain a succession for several weeks. They should be desirable for edging walks and bulb beds. They have a deep-seated rhizome and fleshy roots. The bulbs are procurable from Colorado and California, either as collected or nursery-grown stock. The genus has only one species. It belongs to an anomalous group, characterized by almost total lack of stem and fls. solitary or clustered among the radical lvs. From the other members of this group it is distinguished by the lvs. not 2-ranked, and an indefinite number of ovules in each locule. Perianth segments narrowly lanceolate, persistent: stamens 6: style persistent, slightly 3-lobed.

montànum, Nutt. Sand Lily of Colorado. Lvs. 8–12 or more, flat, rather thick, 4–8 in. long, 1–3 lines wide: pedicels ½–1½ in. long.

J. H. Cowen.

LEUCÒJUM (name explained below). Also written *Leucoium*. *Amaryllidàceæ*. Snowflake. The Snowflakes are hardy bulbous plants growing a foot or less high and bearing dainty, nodding, 6-parted fls., which are white, tipped with green, yellow, or a tinge of red. They are less popular than Snowdrops (Galanthus), to which they are closely related, and have larger fls., with all the segments of equal size. There are 8 species, natives of Europe and the Mediterranean region, 4 of which are cult. Perianth-tube none; segments ovate or oblong. Baker, Handbook of the Amaryllideæ, 1888. The name Leucojum was given by Linnæus, but he did not explain the application. The old Greek name, *Leucoion*, was given by Theophrastus to a plant now supposed to be a crucifer, like some stock or wallflower. *Leucoion* is from *leukos*, shining, white, and *ion*, violet. Snowflakes appear about the same time as white violets, and sometimes have a delicate odor, resembling that of the violet, but the form of the fls. is very different. For culture, see *Bulbs*.

A. *Blooming in March.*

vérnum, Linn. Spring Snowflake. Bulb globose, ¾–1 in. in diameter: lvs. strap-shaped, finally 6–9 in. long, 4–6 lines wide: scape ½–1 ft. long, usually 1-fld.: perianth segments white, tipped green: seeds with a pale, membranous coat and conspicuous strophiole. Central Eu., France to Bosnia and Tyrol. B.M. 46. G.C. II. 11:399; 21:341; 23:341. P.G. 5:47. Gn. 25, p. 335, and 29, p. 607. V. 8:69. Var. **Carpáthicum**, Herb., has perianth segments tipped yellow. B.M. 1993. J.H. III. 32:169. G.M. 39:105. A choice form, usually bearing 2–4 fls.

AA. *Blooming in April and May.*

æstivum, Linn. Summer Snowflake. Bulb ovoid, 1–1½ in. in diameter: lvs. strap-shaped, 1–1½ ft. long: scape 1 ft. long, 4–8-fld.: perianth segments white, tipped green: seeds with a black, hard-shelled coat and no strophiole. Blooms end of April and beginning of May. Central and S. Eu. Mn. 9:45. P.G. 1:7. V. 3:342 and 8:70.

pulchéllum, Salisb., differs from *L. æstivum* by its smaller fls. and capsule, narrower lvs. and fls. a fortnight earlier. Sardinia and Balearic Isles.

AAA. *Blooming in autumn.*

autumnàle, Linn. (*Àcis autumnàlis*, Salisb.). Autumn Snowflake. Bulb globose, ½ in. in diameter: lvs. thread-like, usually produced after the fls.: scape very slender, 3–9 in. long, 1–3-fld.: perianth segments white, tinged with red: stamens half as long as segments. Portugal and Morocco to Ionian Islands. B.M. 960.—Not satisfactory everywhere.

ròseum, Martin. Bulb globose, ¼–½ in. in diam.: peduncle shorter and usually 1-fld.: perianth segments ½ in. long, rose-red, oblanceolate: stamens ½ in. long. Corsica.—Usually difficult to grow, and little known horticulturally.

J. N. Gerard and W. M.

LEUCOPHÝLLUM (Greek, *white leaf*). *Scrophulariàceæ*. This includes a rare shrub from southern Texas, the leaves of which are covered beneath with silvery white wool. It has showy violet-purple, bell-shaped fls. an inch across, borne in spring. In cultivation it flowered for the first time in 1890, at Augusta, Ga., with P. J. Berckmans. It is now cult. in S. Fla., and deserves cultivation everywhere in the South. According to C. S. Sargent, "There is no shrub of the desert portions of the valley of the lower Rio Grande more generally distributed, and certainly there is not one of them which more delights the traveler in the early spring months, when the large, violet-purple flowers of this plant heighten the effect of its brilliant silvery foliage." (G.F. 3:488.)

Leucophyllum has only 2 species. Lvs. all alternate, ovate or obovate: calyx 5-cut; corolla tube broad and short; lobes 5, rounded; stamens 4, didynamous, included, fixed at the base of the corolla: ovary 2-celled; ovules numerous: capsule 2-valved: seeds oblong.

Texànum, Benth. Loose-growing, straggling shrub, 4 or 5 ft. high in the wild, 8–10 ft. high in cult. Lvs. ⅓–1 in. long, obovate: fls. axillary, slightly hairy within. G.F. 3:489.

LEUCOSTÈGIA (Greek, *white roof;* alluding to the indusia). *Polypodiàceæ.* A small genus of Indian ferns allied to Davallia, with a small, narrow, thin indusium attached by its base, with the apex and sides free. The leaves are mostly tri-quadripinnate. For cult., see *Davallia.*

párvula, Wallich. Rootstocks wide-creeping, scaly: lvs. nearly sessile, deltoid, less than 1 in. long, half as wide, usually tripinnate. Singapore and Borneo.

L. M. UNDERWOOD.

LEUCÒTHOË (Greek mythological name; daughter of Nereus). *Ericàceæ.* Including *Agarista.* Ornamental low evergreen shrubs, with alternate, short-petioled, usually serrate lvs. and with white, rarely pink or scarlet, usually nodding fls., in terminal or axillary racemes, appearing mostly in spring. The S. American species, which are very rare in cultivation, though they surpass the other in beauty of the fls., are hardy only South, while the other species can be grown as far north as Mass. and western N. Y., the evergreen ones in sheltered positions or with slight protection during the winter. They are very handsome for borders of shrubberies or as undergrowth in open woods. They thrive best in somewhat moist, peaty or sandy soil, and prefer shaded or partly shaded situations, but also grow in full sun if the soil is not too dry. Prop. usually by seeds sown in peaty, sandy soil in pans or boxes in spring, and treated like those of Azalea or Rhododendron; also by layers or division; the evergreen species grow from cuttings under glass in late summer, but root rather slowly. About 35 species in N. and S. America, Madag., Himal. and Japan, formerly often united with Andromeda. Lvs. evergreen or deciduous: fls. in axillary or terminal racemes; calyx 5-parted, imbricate; corolla ovate or cylindrical; stamens 10; anthers obtuse or 2-pointed at the apex: capsule separating into 5 valves; seeds minute, irregular. Most of the allied genera differ by the valvate calyx, and Chamædaphne by the valves of the capsule separating into 2 layers, the inner one 10-valved.

A. *Lvs. evergreen: racemes axillary, sometimes clustered, shorter than the lvs.*

B. *Racemes dense, sessile, many-fld.: pith of branches solid.*

axillàris, Don (*Andrómeda axillàris*, Lam.). Shrub, to 5 ft., with spreading and usually recurving branches, puberulous when young: lvs. with short pubescent petioles, oval to oblong-lanceolate, shortly acuminate, serrulate toward the apex, glossy above, pale and sparsely pubescent beneath when young, 2–4 in. long: racemes 1–2 in. long: sepals broadly ovate; corolla white, usually greenish in bud, ¼in. long. April, May. Va. to Fla. and Ala. — Var. **longifòlia**, Pursh. Lvs. linear-lanceolate. B.M. 2357.

Càtesbæi, Gray. To 6 ft., similar to the former, with glabrous, slender and more arching branches: lvs. longer-petioled, ovate-lanceolate to lanceolate, ciliately appressed-serrate, glossy above, usually light green beneath, glabrous, 3–7 in. long: racemes larger: sepals narrower; corolla over ¼in. long, white, usually reddish in bud. April, May. Va. to Ga. B.M. 1955. L.B.C. 14:1320.—This species is handsomer than the former, and also somewhat hardier: lvs. and fl.-buds assume a beautiful purple hue, late in fall which is retained through the winter.

BB. *Racemes peduncled, with rather few, slender-pedicelled fls.: pith laminate.*

acuminàta, Don (*L. populifòlia*, Dipp. *Andrómeda acuminàta*, Ait.). Shrub, to 12 ft., with spreading branches: lvs. short-petioled, ovate-lanceolate, acuminate, entire or obscurely serrulate, glabrous, 2–4 in. long: pedicels as long as corolla: calyx very short; corolla cylindrical, over ⅓in. long. June. S. C. to Fla.

AA. *Lvs. deciduous: racemes mostly terminal, secund, longer than the lvs.* (*Subgenus Eubotrys.*)

racemòsa, Gray (*Andrómeda racemòsa*, Linn. *L. spicàta*, Don. *Lyònia racemòsa*, Don). Shrub, to 10 ft., with mostly erect branches: lvs. oblong to ovate, acute, serrulate, pubescent beneath, at least on the veins, 1–3 in. long: racemes erect, 2–4 in. long: corolla cylindrical, ⅓in. long. April–June. Mass. to Fla. and La. Em. 423.

recúrva, Gray. Similar to the last, but lower and more spreading: lvs. elliptic-ovate to elliptic-lanceolate, acuminate: racemes spreading and recurved: capsule depressed and strongly lobed. April–June. Va. to Ala. G.F. 9:225.—It grows in drier situations, but otherwise it is not superior to the former; the foliage of both assumes a splendid scarlet color in fall.

L. Dàvisiæ, Torr. Evergreen shrub, to 5 ft.: lvs. oblong, obtuse, crenately serrulate: racemes slender, many-fld., clustered in terminal panicles. May, June. Calif. B.M. 6247.—*L. Grayàna*, Maxim. Half-evergreen: lvs. large, broadly oval, appressed-pilose: racemes terminal, slender: fls. rather small. June. Japan.—*L. neriifòlia* DC. (Agarista neriifolia, Don). Evergreen, glabrous shrub, with ovate-oblong, acuminate lvs. and bright scarlet fls. in erect, slender racemes at the end of the branches. Brazil. B.M. 4593.—*L. púlchra*, DC. (Agarista pulchra, Don). Evergreen shrub, 2 ft. or more high, glabrous: lvs. ovate, mucronate, about 1 in. long: fls. white, in spreading, peduncled, slender racemes, much longer than the lvs. Caracas. B.M. 4314.—*L. populifòlia*, Dipp.—L. acuminata, in main list.

ALFRED REHDER.

Leucothoë Catesbæi is one of our most ornamental and popular hardy broad-leaved shrubby evergreens. It is used for massing in connection with Rhododendrons, Kalmias, etc., serving as a base for these taller varieties. The shiny dark green leaves are borne with regularity on a recurved stem often 2–3 ft. long, and sometimes coloring brilliant bronze and claret shades in autumn when exposed to the direct rays of the sun. Leucothoë sprays are largely used by florists in making up designs and in connection with Galax leaves, usually, however, in the more informal pieces. They were introduced to the trade about 1890. The fragrant flowers are in the leaf axils, borne along the stem in early spring, and are usually conspicuous, considering the fact that the leaves are persistent. It is this graceful evergreen spray effect, with the good color and dense habit, that makes Leucothoë so desirable as a plant for massing, and also the fact, perhaps, that it is fairly easy to transplant. Seeds are produced freely, and can be sown in sphagnum moss and sand under glass, as Rhododendrons and Azaleas are grown, pricked off in flats and planted outdoors in early spring, when the plants are a few inches high. Leucothoë is also propagated by division, underground runners and cuttings, the latter being plunged in sand on the bench and given moderate bottom heat. It is usually collected, however, in its native habitat, in small plants, transplanted to nursery rows and grown for several seasons. HARLAN P. KELSEY.

LEVERWOOD. *Ostrya Virginica.*

LEVÍSTICUM (a modification of a name given by Dioscorides to some umbelliferous plant). *Umbelliferæ.* LOVAGE is a plant grown for its aromatic seeds, which are used in confectionary. The leaf-stalks were formerly blanched and eaten like celery. It is a tall, hardy perennial herb, with large, 2–3 times divided radical lvs. The plant may be propagated by seed sown as soon as ripe, but when plants are already established root-division is less troublesome and risky. Division may be made in the autumn, but better in the spring. The divided plants and the seedlings, when 2 or 3 in. tall, should be set in checks 3 ft. apart in deep, rich soil. When well established the plants remain profitable for many years, demanding but little attention. The genus has only one species, and is distinguished by having the bracts of its involucel grown together.

officinàle, Koch. Lovage. Tall: lvs. dark green, shining; segments wedged shaped at the base, cut toward the apex: fls. yellow: seeds 3-ribbed, hollow and boat-shaped on one side, convex on the other. S. Eu.

LEWÍSIA (after Meriwether Lewis, of the famous Lewis and Clark expedition across the continent to the Pacific in 1804). *Portulàcaceæ.* The Bitter-root, *L. rediviva,* is an odd and interesting plant. It has a thick-branched root: lvs. like a Portulaca, fleshy and linear, and handsome fls. borne 3 or 4 in. above ground. The fls. are 1–2 in. across, rosy, varying to white, red or purplish, with 8–14 petals. The plant has been thoroughly tested in the East, and is desirable for rockeries, needing perfect drainage, a sunny position and careful watering while in flower. One of those perennials that should be planted in groups for best effect, and also as a precaution to prevent loss by oversight in careless weeding during flowerless period.

The starchy root is dug by the Indians in spring, and eaten. The bark is ordinarily very bitter, but at flowering time it is said to slip off easily, and the root when boiled has little of the bitter taste. The roots from which the plant was described showed signs of life after being in the herbarium for several years. Pursh planted them, and they grew for a year. This event suggested the name *rediviva.* The fine fls. figured in B.M. 5395 came from a root which had been immersed in boiling water in order to make an herbarium specimen. The root is called spatulum or spatlum by the Indians. The Lewis and Clark expedition was planned in the house of Bernard M'Mahon, an early American horticulturist. (See *M'Mahon*). A full account of this plant is given by Pailleux and Bois in Le Potager d'un Curieux; also in R.H. 1892, p. 298. Generic characters are: sepals 5–8, persistent; stamens numerous: style 6–8-parted: capsule circumscissile. The genus has 2 species.

rediviva, Pursh. Fls. June–Aug. Wash. and Calif. to Nev. B.M. 5395. R.H. 1892, p. 298. V. 2:306. Mn. 2, p. 85.

J. Woodward Manning and W. M.

LIÀTRIS (a name of unknown derivation). *Compósitæ.* Blazing Star. Button Snakeroot. A genus of hardy perennials, confined to eastern and southern N. America. Fifteen or more species have been recognized, all of which are best adapted to the wild-flower border. The most showy are *L. elegans* and *L. pycnostachya.* All produce their flowers in wand-like spikes or racemes, the petaloid coloring of the involucral bracts often adding to the effect of the usually bright rose-red or purple flowers. Their flowers are produced in late summer and autumn. They multiply by offsets from their corm-like base, or may be grown from seed, which should be sown in autumn. They will grow and produce flowers in poorer soil than most garden plants, but thrive best in good, rich garden soil, and require no special care. When grouped in masses they give best results.

A. *Bracts of involucre obtuse.*

B. *Heads hemispherical,* ½–1 *in. broad, 15–45-flowered, and peduncled.*

scariòsa, Willd. Stem stout, 1–5 ft. high: lower lvs. spatulate or oblong-lanceolate, 4–6 in. long, ½ in. wide; upper narrowly lanceolate: heads large, numerous, in a relatively loose spike; involucral bracts often tinged with purple: fls. purple: pappus bristles minutely barbellate. Throughout the U. S. and Can., east of the Rocky Mts. B.M. 1709. B.R. 7:590 and 20:1654. G. C. III. 14:593. D. 271. P.M. 5:27 (as *L. borealis*).—Next to *L. elegans* and *pycnostachya*, perhaps the most desirable species for ornamental purposes.

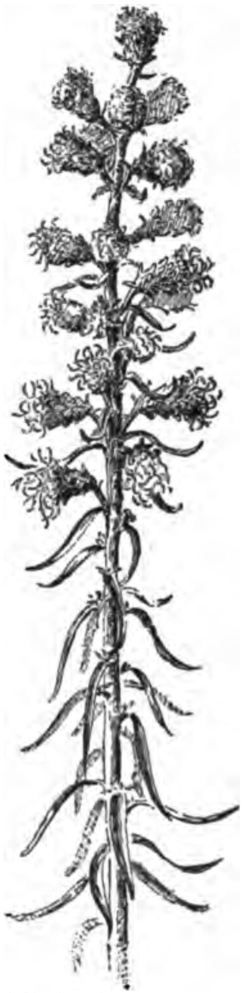
BB. *Heads oblong. 3–4 lines broad, 5–15-flowered.*

C. *Bracts not punctate.*

D. *Heads sessile.*

spicàta, Willd. Stem stout, rather tall, 2–5 ft., and very leafy: lvs. all linear, the lower larger and broader than the upper, which are gradually reduced to the linear-subulate bracts of the spike: heads 8–13-fld., ½ in. long, closely sessile, and forming a dense spike from 6–12 in. long; involucral bracts rounded obtuse, with usually purplish margins. In the Atlantic and Gulf states, from Mass. to La. B.M. 1411.

Var. **montàna,** Gray (*L. pùmila,* Lodd.). Fig. 1270. Lower, 10–20 in. high: lvs. broader, the lower ones ½–¾ in. broad, and obtuse at apex: spike proportionately short and heads larger. Va. and N. Car., in the mountains. L.B.C. 2:147.



1270. Liatris spicata, var. montana (× ½).

DD. *Heads distinctly pedicelled.*

E. *Lvs. oblong-lanceolate, relatively short.*

gràcilis, Pursh (*L. pauciflosculòsa,* Nutt. *L. lanceolàta,* Bertol). Stem slender, 1–3 ft. high: lower lvs. oblong-lanceolate, upon distinct petioles, upper reduced to small linear bracts: heads in a loose raceme, 3–5-fld.; bracts of the involucre few and rather loose. Georgia, Ala. and Fla.

EE. *Lvs. attenuate-linear, the radical 8–12 in. long.*

tenuifòlia, Nutt. (*L. lævigàta,* Nutt.). Stem slender, 2–4 ft. high: lvs. without distinction of blade and petiole, only a line or two wide: heads in a strict raceme, a foot or more long, about 5-fld.: pappus strongly barbellate. N. Car. to Fla.

CC. *Bracts punctate: heads peduncled.*

graminifòlia, Pursh. Stem comparatively slender, 2–3 ft. high: lvs. ciliate toward the base, with scattered hispid hairs: spike less dense, often becoming racemose: head ½ in. long; bracts of involucre punctate, rounded at the apex. Atlantic states, Va. to Fla.

AA. *Bracts of involucre acute or mucronate.*

B. *Heads 15–60-fld., cylindrical or turbinate.*

C. *Bracts with lanceolate, spreading, rigid tips.*

squarròsa, Willd. Stem stout, 6–20 in. high: lvs. linear and rigid, the lower elongated and grass-like: spike variable in length, bearing few to many heads, the larger heads 1 in. long; involucral bracts lanceolate, rigid, and usually bearing pointed tips, squarrose. Eastern U. S., as far west as Neb. and Tex. B.R. 11:948 is var. **intermèdia** of this species.

CC. *Bracts with closely appressed, mucronate tips.*

cylindràcea, Michx. Stem 1 ft. high: lvs. and spike as in last species: heads few, 16–20-fld.; bracts of involucre abruptly mucronate. Upper Can. to Minn. and Mo.

BB. *Heads 3–6-fld., oblong or narrowly campanulate.*

C. *Inner bracts much longer than the fls.*

élegans, Willd. Stem 2–3 ft.: lvs. linear, the upper soon reflexed: spike dense and wand-like, 3–20 in. long: heads ½ in. long; inner involucral bracts prolonged into spreading, petaloid appendages, which surpass the flowers and pappus. Va., to Fla. and Tex. B.R. 4:267.

CC. *Inner bracts not longer than the fls.*

D. *Pappus bristles very plumose: bracts appressed.*

punctàta, Hook. Stem stout, 10–30 in. high: lvs. and involucral bracts punctate and rigid: spike long and wand-like, dense and leafy: heads 4-6-fld., ¾ in. long; bracts of involucre oblong, rather abruptly cuspidate, ciliate on its margins: pappus plumose. Saskatchewan and Minn. to Tex. and Mex.

DD. *Pappus bristles merely barbellate.*

E. *Involucral bracts spreading.*

pycnostàchya, Michx. Stem stout, 3–5 ft. high: lvs. crowded throughout, the lower lanceolate, the upper narrowly linear: spike densely flowered, 5–18 in. long: heads about ½ in. long, all sessile; involucre with squarrose tips acute, purplish: pappus copious, minutely barbellate. Ill. and Ia., to Ark. and Tex. R.H. 1883:324. Gn. 55:1217.—One of the choicest and boldest species.

EE. *Involucral bracts appressed.*

Chápmanii, Torr. & Gray. Stem a foot or two high, strict and rigid: lvs. short, the lower oblong-linear, the upper small and awl-shaped: spike densely flowered, often 1 ft. long: heads about 3-fld.: fls. large for the size of the head: pappus grayish, the bristles minutely barbellate, about ⅓ in. long. Fla. W.W. ROWLEE.

LIBÉRTIA (Marie A. Libert, a Belgian woman, who wrote on liverworts, about 1820). *Iridàceæ.* This includes some tender bulbous white-fld. plants procurable from Dutch dealers, but for northern gardens inferior to our common hardy Blue-eyed Mary (*Tradescantia Virginica*). The fls. appear to be 3-petaled, the showy parts being the inner segments of the perianth. The fls. are about 1 in. across, and numerous in large clumps of certain species. Rhizome short: lvs. linear, equitant: perianth without any tube above the ovary; segments obovate, the 3 outer usually shorter, firmer and less showy than the inner, more or less green or brown; stamens inserted at the base of the segments; filaments free or connate toward the base: ovules many, superposed: capsule small, leathery, loculicidally 3-valved: seeds 3-cornered.

The genus has 8 species, found in Australia, New Zealand, Tasmania and Chile. All are white-fld. except *L. cærulescens*, which is blue. Botanically it is nearest to Diplarrhena, but in the latter the inner segments are shorter than the outer ones and connivent. Libertia belongs in the same subtribe with our blue-eyed grass (Sisyrinchium), but in the latter case all the perianth segments are about equal in size. Baker, Handbook of the Irideæ, 1892.

A. *Clusters lax: pedicels longer than the bracts.*

B. *Lvs. 3–6 in. long, entirely green.*

pulchélla, Spreng. Lvs. not rigid: stem ½–1 ft. long: inflorescence of 1 or few clusters, which are 2–3-fld. S. Australia, Tasmania, New Zealand.

BB. *Lvs. 1 ft. or more long, with a broad pale midrib.*

ixioides, Spreng. Stem 1–2 ft. long: inflorescence an ample panicle with numerous peduncled, 2–6-fld. umbels. New Zealand.

AA. *Clusters dense: pedicels shorter than the bracts.*

formòsa, Grah. Lvs. rigid, 1–1½ ft. long: stem 2–3 ft. long: inflorescence of many sessile umbels. Chile. B.M. 3294. B.R. 19:1630. Gn. 45, p. 192 (fine habit sketch) and 40, p. 441 W. M.

LIBOCÈDRUS (*libas*, drop, tear, and *Cedrus*; alluding to the resinous character of the trees). *Coniferæ.* Syn., *Heydèria.* INCENSE CEDAR. Ornamental, tall evergreen trees of pyramidal habit, with frond-like arranged, mostly flattened branchlets, small, scale-like, opposite lvs., and rather small, ovate or oblong cones. None of the species is quite hardy North, but *L. decurrens* thrives in the vicinity of the city of New York, and even in sheltered places in E. Mass. It is a valuable park tree, forming a symmetrical, narrow pyramid, with bright green foliage. It is also an important timber tree, the wood being light, soft, close and straight-grained, is very durable in the soil, and is used for fencing, for shingles, for the interior finish of houses, and also for ship and boat building. The other species are hardy only South, and, though very ornamental trees, they are hardly cultivated in this country; they are all important timber trees in their native countries. The Incense Cedars thrive best in a well-drained soil, and prefer open situations; they are liable to lose their lower branches rather early. Prop. by seeds sown in spring; also by cuttings under glass in late summer or fall, which root rather slowly; sometimes grafted on Thuya and Chamæcyparis. Eight species in W., N. and S. America, Australia and S.W. China. Allied to Thuya. Branchlets flattened, rarely quadrangular, frond-like in arrangment: lvs. scale-like, with decurrent base, with or without glands: fls. monœcious or diœcious, terminal, similar to those of Thuya: cones oblong to ovate, with 4, rarely 6, woody scales, the lower pair sterile, small and short, the second one much larger and fertile, each scale bearing two long-winged seeds, the third pair, if present, connate into a woody septum.

decúrrens, Torr. (*Thùya Craigiàna*, Murr. *T. gigantèa*, Carr., not Nutt.). WHITE CEDAR. Tree, to 100 ft., with erect or spreading, short branches, forming a rather narrow, feathery head; bark bright cinnamon-red: branchlets much flattened, bright green on both sides: lvs. oblong-ovate, adnate, with long decurrent base, free at the apex and acuminate, glandular on the back: cones oblong, ¾–1 in. long, light reddish brown; scales mucronate below the apex, a third connate pair separating the 2 fertile ones. Oreg. to Calif. and W. Nev. S.S. 10:534. F.S. 9, p. 199. Gn. 29, pp. 266, 267.—In cult. the young trees are conspicuous by their bright and deep green foliage, while the trees in their native localities are mostly of a light yellowish green. Var. **compácta**, Hort. Dwarf compact form of globose habit. Var. **glaùca**, Hort. With glaucous foliage.

L. Chilénsis, Endl. Tree, to 60 ft., with compact, pyramidal head; branchlets much compressed: lvs. glaucous green, small, erect-spreading, obtuse, with a silvery line beneath: cones ovate oblong, ½ in. long. Chile. P.F.G. 1, p. 47. G.C. 1850, p. 439. R.H. 1867, p. 410. Gn. 30, p. 552.—*L. Doniàna*. Endl. (L. plumosa, Sarg.). Tree, to 100 ft., with dense, pyramidal head: similar to the former, but lvs. larger, more closely set and more spreading, without any silvery line beneath: scales of the cone with a large, curved spine on the back. New Zealand. N. 2:261. This species is the most tender of this genus.—*L. tetrágona*, Endl. (L. cupressoides, Sarg.). Tree, to 100 ft., with compact, pyramidal head, sometimes shrubby: branchlets almost tetragonal: lvs. ovate or ovate-lanceolate, with slightly spreading and acute apex: cones ovate; scales with a large, curved spine on the back. Chile to Patag. G.C. 1850, p. 439. Gn. 30, p. 553.

ALFRED REHDER.

LIBONIA floribunda and Penrhosiensis. See *Jacobinia*.

LICUÀLA (Molucca name). *Palmàceæ.* Low, shrubby fan palms: stems solitary or in groups: lobes of the lvs. long, wedge-shaped, plicate, truncate and variously lobed or split, deeply and irregularly divided; rachis very short; ligule short: sheaths fibrous: fls. large. Species 36 or more, from trop. Asia to trop. Australia. Allied genera in cult. are Brahea, Serenoa, Erythea, Pritchardia, Livistona, Trachycarpus, Rhapis. From these Licuala is distinguished by the carpels of the ovary 3-angled, slightly coherent; style single, filiform: albumen equable: embryo dorsal.

A. *Lvs. with lobes more or less grown together: lobes very broad.*

B. *Marginal teeth very large, the upper edges bent under.*

Rúmphii, Blume. Petiole spiny below: segments 12–15, the inner ones 2 ft. long and 1 ft. wide at the apex, the lateral ones 16 in. long and 4 in. wide, oblique: marginal teeth broadly ovate, obtuse, shortly bifid. Celebes. Cult. in S. Fla.

BB. *Marginal teeth with upper edges not bent under.*

grándis, H.Wendl. (*Pritchárdia grándis*, Bull). Erect palm, the stems clothed above with dead sheaths: lvs. very many, erect-spreading; petiole 3 ft., slender, glabrous, with stout, short, straight or curved spines along the margins below the middle; blade orbicular or semi-orbicular, very closely plicate, wedge-shaped or truncate at the base, concave, the margins with many short lobes which are obtusely 2-fid: ligule thick, short, acute, broadly ovate. New Britain. I.H. 28:412 and 41, p. 82. G.C. II. 1:415. B.M. 6704. A.F. 7:1145. F.E. 7:962. S.H. 1:344.

AA. *Lvs. digitately divided: lobes narrow.*

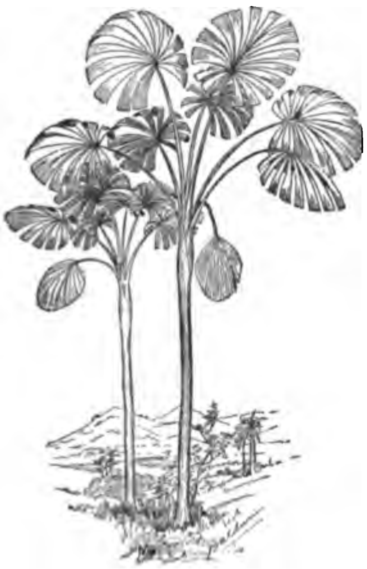
B. *Lobes less than 12.*

Jeanénceyi, Sander. A dwarf, rapidly growing palm: lvs. deep shining green: lobes blunt, 5 to 8. New Guinea. Gn. 55, p. 71. F.E. 11:291. G.M. 41:341.

BB. *Lobes 12 or more.*

C. *Petioles without spines in the upper part.*

élegans, Blume. Stems thick as a man's body, 4 ft. high, prominently scarred: petioles 3–4½ ft. long, the margins with brown hooked spines to just above the middle; lvs. orbicular; lobes very graceful, the linear-lanceolate lateral ones gradually decreasing to 11 in., obliquely truncate, with acute teeth, the middle lobes 16 in. long, truncate, with broader obliquely ovate obtuse teeth, lobes with only 2 or 3 folds. Sumatra.



1271. Licuala peltata.

CC. *Petioles spiny throughout.*

D. *Lvs. ascending.*

peltàta, Roxb. Fig. 1271. Lvs. 3–5 ft. diam., orbicular; lobes very variable in length and width, many-toothed at the apex, the teeth ½–2 in.; petiole stout, 3–4 ft. long. The lobes of the lvs. droop very gracefully. G.C. 1872:1657. India.—Adv. 1895, by Pitcher & Manda. Fig. 1271 is redrawn from Martius.

DD. *Lvs. horizontally spreading.*

spinòsa, Wurmb. (*L. hórrida*, Blume). Lvs. 3 ft. or more in diam., orbicular-reniform; inner lobes 18–22 in. long, 4½–5 in. wide at the apex, 10–11-toothed; outer lobes 15 in. long, 1½–2 in. wide, 4–6-toothed; teeth rather large, triangular-ovate, bifid; petioles obtusely 3-angled, 4–5 ft. long, with brownish hooked spines. Java, Moluccas.

JARED G. SMITH.

Licualas are very handsome warmhouse palms of moderate growth, several species of which have been grown to some extent commercially. They delight in a tropical temperature and abundant moisture, and should also be shaded from strong sunshine in order to produce foliage of the deep, rich shade of green that is common to this genus.

The most attractive species is *L. grandis*, which has been until recent years a costly species owing to its comparative rarity in cultivation. It is probably within ten years that the first consignment of seeds of this species was received in America.

The large fan-shaped leaves of the Licualas are somewhat tender and easily injured, which makes them of less value for house decoration, but as exhibition plants there are few palms more striking than *L. grandis*, and *L. elegans*. *L. spinosa* and *L. peltata* are also well worth cultivation, though objection is sometimes found to the strong hooked spurs with which their leafstalks are armed.

W. H. TAPLIN.

LIGULÀRIA. All referred to *Senecio*.

LIGÚSTICUM (Latin, referring to the ancient province of Liguria, where a plant was gathered which was something like this and used in medicine.) *Umbelliferæ*. This includes a native hardy herbaceous plant suitable for naturalizing with aquatics and bog plants. It has a bold habit, grows 2–6 ft. high and has ternately decompound foliage. Offered by dealers in native plants. The genus has about 20 species scattered in the northern hemisphere. They have large aromatic roots, mostly no involucre, involucels of narrow bractlets and white fls. in large, many-rayed umbels. Consult our manuals or Coulter and Rose's "Revision of North American Umbelliferæ," 1888.

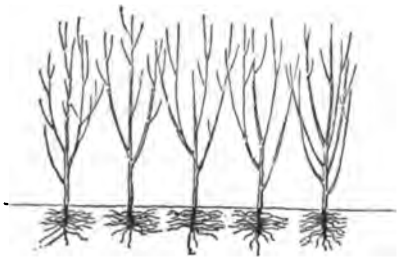
actæifòlium, Michx. Stem stout, branched above: lvs. 3–4-ternate; lfts. 2–5 in. long, coarsely serrate, broadly oblong: umbel 10–20-rayed: fruiting rays 1–2 in. long. July, Aug. Rich ground, S. Pa. to Gulf of Mex. B.B. 2:519.—Int. by H. P. Kelsey.

W. M.

LIGÚSTRUM (ancient Latin name). *Oleàceæ*. Including *Visiània*. PRIVET. PRIM. Ornamental shrubs or trees with deciduous or evergreen opposite, entire lvs., white or whitish, mostly fragrant fls. in terminal panicles, and decorative, usually black berries, often remaining on the branches through the whole winter. Some deciduous species, as *L. vulgare*, *Ibota*, *ciliatum* and *Amurense*, are hardy North, while others, like *L. ovalifolium*, *Sinense* and *Quihoui*, can not be considered quite hardy north of Long Island. The evergreen species are only half-hardy or tender, but *L. Japonicum* may be grown as far north as Philadelphia. They are all very valuable for shrubberies, with their clean, dark green foliage, which is rarely attacked by insects and keeps its green color mostly unchanged until late in fall, though *L. ciliatum* sheds the lvs. rather early and *L. Ibota* and sometimes *L. ovalifolium* assume a pretty purplish hue; in mild winters some of the deciduous species hold part of their foliage until almost spring. *L. vulgare*, *ovalifolium* and others stand dust and smoke well and are valuable for planting in cities. *L. ovalifolium* is one of the best shrubs for seaside planting, growing well in the very spray of the salt water (known as California Privet). Some are handsome in bloom, especially *L. Sinense*, *Ibota*, *Japonicum*, *lucidum* and most of the other evergreen species; all are conspicuous in autumn and winter from the black berries, or in some vars. of *L. vulgare*, whitish, greenish or yellowish. *L. vulgare*, *ovalifolium* and also *L. Amurense* are well adapted for ornamental hedges. The Privets grow in almost any kind of soil, and even in rather dry situations and under the shade and drip of trees. Prop. by seeds sown in fall or stratified, sometimes not germinating until the second year; usually increased by cuttings of hardwood or by greenwood cuttings in summer under glass; vars. are sometimes grafted on *L. vulgare* or *L. ovalifolium*. About 35 species, chiefly in E. Asia and Himalayas, distributed south to Australia, one in Europe and N. Africa: from allied genera distinguished by the terminal inflorescence and from Syringa by the berry-like fr. Lvs. short-petioled, estipulate: fls. perfect, small; calyx campanulate, obscurely 4-toothed; corolla funnel-shaped, with mostly rather short tube and with 4 spreading lobes; stamens 2: fr. a 1–3-seeded berry-like drupe.

ALFRED REHDER.

CALIFORNIA PRIVET FOR HEDGES.—*First method.*—Cuttings 8–14 inches of 1-year wood are made in fall or winter, preferably the former, as they are occasionally damaged by the winter, even as far south as Alabama. These are tied in bundles and buried during winter. In the spring they are stuck in rows 2–6 inches by 2–3½ feet, and kept cultivated. They are sold at 1 year, when 1–2½ feet high, or at 2 years, when 2–4 feet high. If not sold at 2 years the plants are sometimes cut back to 3 inches to sprout again. They are dug by spade or tree-digger. These closely grown plants will make a hedge, as shown in Fig. 1272, especially if dug with spade and given short roots. If 3-year plants, not cut back, are used, the base is open, as the old wood at the lower part of the plant has had its side branches weakened or killed by crowding and they do not readily branch out. Plants grown by this method are frequently planted in a double row.



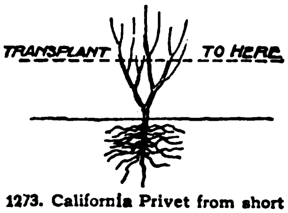
1272. Common method of making Privet hedge. (Scale ½ in. to ft.)

Second method.—Cuttings of 5–6 inches of stout, 1-year wood, are made in November. The cuttings are made short so that the roots will not be cut off by the tree-digger. The leaves are stripped off, and the cuttings tied in small bundles, as large bundles mold. These are buried, tops up, over winter. In the spring, before growth starts, they are planted in rich, mellow land 4 inches apart, with rows 8 inches apart. To plant, a back furrow is plowed in the center of the block, the top raked off, a line stretched and pegged down. The cuttings can then be inserted nearly full length. The trampling of the row settles the soil enough to expose the top buds. With a one-horse plow the bottom of the furrow is loosened where the planters have packed the soil, and new furrows are made around the strip planted. The cuttings are tilled during summer with a wheel-hoe or hand-plow. To make wide plants, the tips of the shoots are pinched when they are about 3 inches long. This is repeated at intervals of about three weeks during the summer. Nitrate of soda may be used to hasten growth. This method produces a plant as shown in Fig. 1273.

The plants may be dug in the fall and heeled-in, to prevent possible winter-killing. They are then sorted into grades and planted in the spring 1½–2 feet apart in rows 3–4 feet apart against the land side of a deep furrow, and a little soil kicked over the roots. The filling is completed with a one-horse plow. Before filling, fine manure may be spread near the plants.

The plants should be straightened up and trampled firm. When finished, they should have the lower branches covered and the lower end of the cutting not below the level of the tree-digger. The pinching-back process may be continued, or the tips may be cut with a sickle during the early part of the season, especially on plants of the smaller grade. To get more roots on the branches the plants may be hilled-up. They are cultivated with a one-horse cultivator or a two-horse riding cultivator. At two years these will make plants 2½–3½ feet high and 1½–2 feet wide at the base.

Dig with a tree-digger that operates on one or both sides. The plants may be set 12–15 inches apart, 4–6 inches deeper than before, and produce a hedge as shown in Fig. 1274. A smaller number of plants is required than when plants grown by the first method are used. As there are numerous vigorous buds near the ground, the growth is very dense at the base. After planting, the tops may be cut off to an even height.



1273. California Privet from short cuttings, transplanted deep. (Scale ½ in. to ft.)

Various forms of hedge are used, as shown in Fig. 1275. No. a is used on Long Island; b is used at Newport. At Newport, by repeated clipping, the leaves become very small and the growth dense, resembling a wall. Nos. d and e frequently result from using narrow plants and allowing them to grow at the top.

Third method.—At Biltmore Nursery, North Carolina, the Privet cuttings are run through a stalk cutter and the pieces sown in a furrow.

HENRY HICKS.

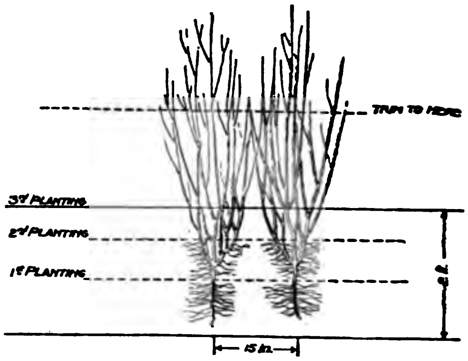
INDEX.

Alivoni, 7.
Amurense, 4.
angustifolium, 1.
aureo-marginatum, 5, 7.
Californicum, 5.
buxifolium, 10.
Chinense, 11.
ciliatum, 2.
coriaceum, 8.
excelsum, 7.
Fortunei, 11.
glabrum, 6.
glaucum, 10.
Ibota, 2, 3, 4.
Italicum, 10.
Japonicum, 5, 6, 7.
Kellerianum, 6.
Kellermanni, 6.
longifolium, 1 and supp. list.
lucidum, 7, 8.
macrophyllum, 7.
magnoliæfolium, 7.
Massalongianum, 1.
meadia, 2.
medium, 2, 5.
myrtifolium, 1.
Nepalense, 9.
obtusifolium, 3.
ovalifolium, 5.
pendulum, 10.
Quihoui, 12.
Regelianum, 3.
robustum, 7.
rosmarinifolium, 1.
sempervirens, 10.
Sieboldi, 6.
Sinense, 7, 11.
spicatum, 1, 6, 7, 9.
Stauntoni, 11 and supp. list.
syringæflorum, 6.
tricolor, 5, 7.
variegatum, 5, 10.
villosum, 11.
vulgare, 10.

A. *Corolla with the tube 2 or 3 times longer than the limb.*

B. *Lvs. linear-lanceolate or linear, evergreen.*

1. **Massalongiànum**, Vis. (*L. longifòlium, angustifòlium, myrtifòlium, rosmarinifòlium* and *spicàtum*, Hort.). Erect shrub, to 3 ft., with warty and pilose branchlets: lvs. tapering at both ends, glabrous, 1½–3 in. long: panicles much branched, many-fld. with rather small pedicelled fls., 2½–3½ in. long. July, Aug. Himal. G.C. II. 16:149.—Graceful half-hardy shrub.



1274. The Privet hedge at final transplanting. (Scale ½ in. to ft.)

BB. *Lvs. oblong to ovate or oval.*

C. *Young branchlets and inflorescence pubescent: lvs. deciduous.*

2. **ciliàtum**, Blume (*L. Ibòta*, Sieb. & Zucc. *L. Ibòta*, var. *ciliàtum*, Dipp. *L. mèdium*, Hort., not Franch. & Sav.). Shrub, to 6 ft., with erect and spreading branches: lvs. rhombic-ovate or ovate-lanceolate, acute at both ends, appressed pubescent near the margin and finely ciliate and pubescent on the midrib beneath, 1–2 in. long: panicles small, erect, about 1 in. long: fls. almost sessile; calyx glabrous: fr. shining. June. Japan.—This is one of the least decorative species; it has been introduced under the erroneous denomination of *L. medium*, which is sometimes misspelled *L. meadia*.

3. **Ibòta**, Sieb. (*L. obtusifòlium*, Sieb. & Zucc.). Fig. 1276. Shrub, to 10 ft., with spreading and curving branches: lvs. elliptic to oblong-obovate, acute or obtuse, usually only pubescent on the midrib beneath, 1–2 in. long: panicles nodding, small, 1–1½ in. long, numerous along the branches on short branchlets: fls. short-pedicelled; calyx pubescent: fr. with slight bloom. June, July. Japan, China. G.F. 6:425. M.D.G. 1899:218.—Graceful shrub, hardy North. Var. **Regeliànum**, Rehder (*L. Regeliànum*, Hort.). Low, dense shrub with almost horizontally spreading branches and oblong or obovate, usually more pubescent lvs.

4. **Amurénse**, Carr. (*L. Ibòta*, var. *Amurénsis*, Hort.). Shrub, to 15 ft., with upright branches: lvs. oval or oblong, usually obtuse, somewhat glossy above, glabrous except the midrib beneath, 1-2½ in. long: panicles erect, often rather many-fld., 1-2½ in. long: fls. short-pedicelled; calyx glabrous or slightly pubescent near the base. June, July. Japan, China. R.H. 1861, p. 352.—Similar in habit to the following and almost half-evergreen.

cc. *Young parts glabrous: lvs. half-evergreen.*

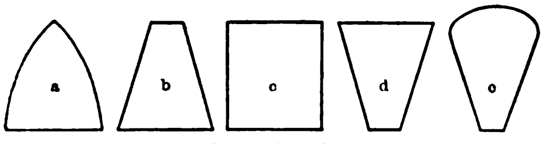
5. **ovalifòlium**, Hassk. (*L. Califórnicum*, Hort. *L. Japónicum*, Hort., not Thunb., and probably *L. mèdium*, Franch. & Sav.). CALIFORNIA PRIVET. Shrub of upright habit, to 15 ft., quite glabrous: lvs. cuneate at the base, elliptic-ovate or elliptic-oblong, acute, dark green and glossy above, yellowish green beneath, 1½-2½ in. long: panicles erect, many-fld., rather compact, to 3 in. long: fls. almost sessile. July. Japan.—A very handsome shrub, but of somewhat stiff habit; well adapted and much used for hedges (see Mn. 6, p. 9). Var. **aureo-marginàtum**, Hort. Lvs. edged yellow. Var. **variegàtum**, Hort. (var. *robústum variegàtum*, Hort.). Lvs. variegated with yellow. Var. **tricolor**, Hort. Lvs. variegated with yellowish and white, pinkish when young (Mn. 2, p. 42).

AA. *Corolla with the tube as long as the limb or shorter.*

B. *Young growths glabrous: lvs. evergreen.*

6. **Japónicum**, Thunb. (*L. glàbrum*, Hort. *L. Kelleriànum*, Vis. *L. Kéllermanni*, *Sièboldi*, *spicàtum* and *syringæflòrum*, Hort.). Bushy shrub, to 10 ft.: lvs. roundish-ovate to ovate-oblong, acute or obtusish, with reddish margin and midrib, veins beneath not distinctly marked, 2-3½ in. long: panicles broad, rather loose, to 4½ in. long; tube usually somewhat longer than calyx. July, Aug. Japan.—Very handsome evergreen shrub, but in colder climates often losing the lvs. in fall; often confounded with the following, and also with the former.

7. **lùcidum**, Ait. (*L. Japónicum macrophýllum*, *L. magnoliæfòlium*, *L. Sinénse latifòlium robústum* and *L. spicàtum*, Hort.). Large shrub or tree, to 20 ft., with somewhat spreading branches, similar to the former: lvs. larger, ovate to ovate-lanceolate, acute or acuminate, distinctly veined beneath, 3-5 in. long: panicles less loose, with almost sessile fls.: tube about as long as calyx. July, Aug. Japan, China. B.M. 2565; 2921 (as *L. Nepalense glabrum*). G.C. II. 10:753.—Larger leaved than the former, but more tender. It yields the white wax, an exudation of the branches, caused by an insect, Coccus Pe-lah; therefore cult. in China. Var. **Alivòni**, Arb. Kew. (*L. Japónicum*, var. *Alivòni*, André). Lvs. ovate-lanceolate, to 8 in. long, acuminate, sometimes with yellowish variegation when young. Var. **aureo-marginàtum**, Hort. (*L. excelsum aureum*, Hort.). Lvs. margined yellow. Var. **tricolor**, Arb. Kew. (*L. Japónicum tricolor*, Hort.). Lvs. with yellowish variegation, pink when young.



1275. Conventional forms of California Privet hedges.

8. **coriàceum**, Carr. (*L. lùcidum*, var. *coriàceum*, Decne.). Dwarf, dense shrub, with short, rigid branches, to 6 ft., very leafy: lvs. orbicular or orbicular-ovate, convex, dark green and shining above, 1½-2½ in. long: panicle compact, 2-4 in. long, with sessile fls. July. Cult. in Japan, not known wild. B.M. 7519. R.H. 1874, p. 418; 1888, p. 440. F. 1876, p. 65.

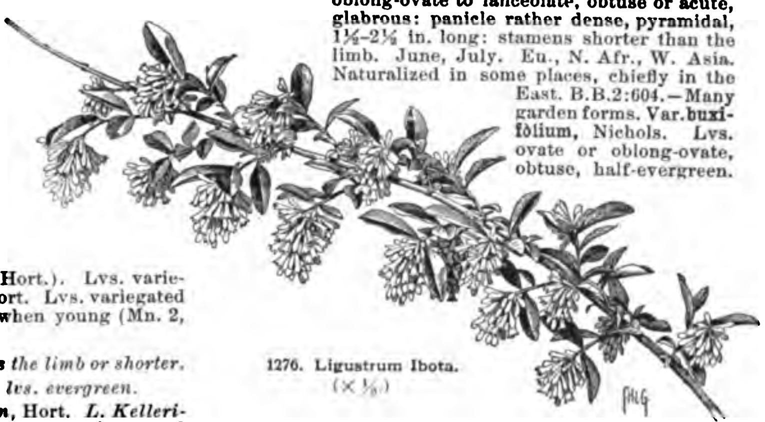
BB. *Young branchlets and inflorescence pubescent or puberulous.*

C. *Lvs. evergreen, 2-5 in. long.*

9. **Nepalénse**, Wall. (*L. spicàtum*, Don). Evergreen shrub or tree, with pubescent branchlets: lvs. oblong or oblong-ovate, acuminate, pubescent beneath, 2-5 in. long: panicles rather large and broad, interspersed with petioled bracts. July, Aug. Himal.

cc. *Lvs. deciduous or half-evergreen, 1-2½ in. long.*

10. **vulgàre**, Linn. COMMON PRIVET OR PRIM. Shrub, to 15 ft.: branchlets and panicles puberulous: lvs. oblong-ovate to lanceolate, obtuse or acute, glabrous: panicle rather dense, pyramidal, 1½-2½ in. long: stamens shorter than the limb. June, July. Eu., N. Afr., W. Asia. Naturalized in some places, chiefly in the East. B.B. 2:604.—Many garden forms. Var. **buxifòlium**, Nichols. Lvs. ovate or oblong-ovate, obtuse, half-evergreen. Var. **glaùcum albo-marginàtum**, Hort. Lvs. bluish green, with narrow white margin. Var. **Itálicum**, Kirchn. (*L. Itàlicum*, Mill. *L. sempérvirens*, Pieri.). Lvs. linear-lanceolate, almost evergreen. Var. **péndulum**, Hort., with pendulous branches. There are also vars. with fruits of different colors, as var. **chlorocárpum**, Loud., with greenish, var. **leucocárpum**, Loud., with whitish, and var. **xanthocárpum**, Loud., with yellowish fruits. Of the variegated forms, var. **aùreum**, Hort., with yellow foliage, and var. **variegàtum**, Hort., with the lvs. blotched yellow, are the most important.



1276. Ligustrum Ibota. (× ⅓.)

11. **Sinénse**, Lour. (*L. Fórtunei*, Hort.). Shrub, to 8 ft., with slender spreading branches: branchlets pubescent: lvs. oval to ovate-lanceolate, pubescent along the midrib beneath, at least when young: panicles pubescent, loose, to 4 in. long, with distinctly pedicelled fls. China, Corea. Two forms can be distinguished. Var. **villòsum**, Rehder (*L. villòsum*, May). Lvs. oval to ovate-lanceolate, obtuse or acute, pubescent beneath, especially along the midrib: panicle narrow. G.C. 1858, p. 621. Var. **Staùntoni**, Rehder (*L. Staùntoni*, DC.). Less high and more spreading: lvs. oval to ovate, obtuse or emarginate, pubescent on midrib beneath, panicle broader and more loose. G.C. II. 10:365. G.F. 3:213.

12. **Quihòui**, Carr. Shrub, to 6 ft., with spreading branches: branchlets and panicles finely pubescent: lvs. elliptic-oblong or narrow-oblong, obtuse, glabrous, somewhat coriaceous, 1-2 in. long: fls. almost sessile, in small clusters, forming at ends of the branches long, panicled spikes. June-Aug. China. G.C. II. 18, p. 277.

L. brachystàchyum, Decne. Closely allied to L. Quihoui, but of upright habit, with larger lvs. and shorter, more compact panicles.—*L. compáctum*, Hook. f. & Thomps. (L. lancifolium, longifolium, lineare and Simoni, Hort.). Evergreen shrub, quite glabrous: lvs. lanceolate, to 6 in.: panicle large, compact: tube short. Himalayas.—*L. insulàre*, Decne. (L. Stauntoni, Hort., not DC.). Shrub, to 6 ft., allied to L. vulgare: lvs. elliptic-ovate to linear-lanceolate, yellowish green, often pendulous, 2-3 in.: panicles rather large. Origin uncertain.—*P. Lekinénse*, Hort. = Syringa Pekinensis.—*L. strongylophýllum*, Hemsl. Evergreen shrub or small tree, almost glabrous: lvs. orbicular or obovate, ½-1 in.: panicle rather loose. China.—*L. Wálkeri*, Decne. Allied to L. Nepalense: lvs. ovate to lanceolate, glabrous, to 3 in.: panicle large, to 6 in. Ceylon, Neilgherries. G.C. III. 24:282. G.M. 41:683.

ALFRED REHDER.

LILAC. See *Syringa*.

LÍLIUM (ancient Latin name). *Liliàceæ.* LILY. The Lilies have always been looked upon as amongst the noblest of garden plants. Their conspicuous flowers, striking colors, and their stately forms appeal strongly to the eye and to the imagination as well. They are among those good "old-fashioned" plants which frequently and justly come newly into vogue. Lilies are less understood and less discriminatingly appreciated than almost any other plants of prominence. The Tiger Lily is a favorite and old-fashioned flower, to be found in many of the most homely and unpretending gardens. Now and then one finds a good group of the Madonna Lily, very rarely a cluster of the beautiful little Coral Lily, and sometimes the landscape gardeners furnish free-handed clients with masses of the Gold-banded Lily in the shrubbery borders. The Easter Lily is largely forced by the florists, as are also certain varieties of the Speciosum group. But aside from these, no Lilies can at present be classed as real favorites of the American public, while dozens of magnificent kinds are practically unknown.

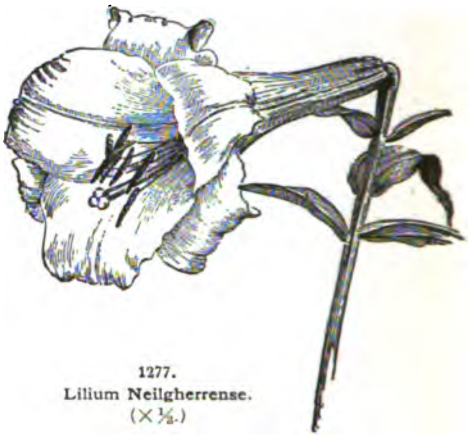
In the opinion of the writer, the three best Lilies for everybody to grow are *L. tigrinum*, var. *splendens; L. speciosum*, var. *rubrum;* and *L. tenuifolium*. To these the following species may be added as well worthy of general culture, at least in the eastern states (the order given is approximately that of the writer's preference): *L. elegans* (many varieties, all good), *auratum, concolor* and its var. *partheneion* (the Coridion Lily), *Brownii, Henryi, Chalcedonicum, testaceum, candidum, maculatum, puberulum, Japonicum* var. *roseum, longiflorum, pomponium*. The connoisseur should not be without *L. Maximowiczii, Canadense, Parryi, Nepalense, monadelphum, pardalinum, superbum, Washingtonianum, Grayi, Wallichianum, Philadelphicum, Columbianum, Neilgherrense*. All these will succeed fairly well, and many of them are of the easiest possible culture.

Lilies are ornamentally useful principally for their flowers. Their foliage is seldom of a character to assist in any scheme of garden decoration. Certain species bear flowers in such quantity and of such pronounced colors that they make very effective masses. Such strokes of color can best be worked into the garden picture at carefully chosen points in the borders, especially where the rich sunlight of early morning or late afternoon takes its rest. For fine mass effects of this kind the divers varieties of *L. elegans*, particularly var. *fulgens*, are excellent. *L. tigrinum*, var. *splendens* and *L. tenuifolium* are also striking; while other sorts which mass well, but are of more modest colors, are *L. speciosum, auratum, Chalcedonicum, concolor*, and *Brownii*. Lilies of many sorts are highly agreeable when scattered—not massed—somewhat freely through shrubbery borders, or with large hardy perennials. Almost any Lily is satisfactory when so placed, but the varieties must not be mixed, and there should be enough plants to avoid a feeling of thinness and isolation.

Lilies are native to the north temperate zone. The majority of our best garden Lilies, such as *L. tigrinum, auratum, speciosum*, and the fine new *Henryi*, come from western Asia, whereas none of the American species is especially successful in our gardens. Throughout Japan, eastern and southern China and Burma, and the adjacent islands, are found dozens of the most gorgeous species.

The genus Lilium is the type of the order Liliaceæ, a family crowded with plants of garden value. The family has over 2,000 well-known species, and of the 187 genera probably half are in cultivation. There are many monographs of the genus Lilium in rare and costly works and in various languages. The latest and most sumptuous one is "A Monograph of the Genus Lilium," by Elwes, published in 1880, with magnificent colored plates. It is referred to below by the abbreviation El. Unfortunately, there is no recent book on Lilies in the English language which combines the horticultural and botanical points of view. The latest botanical review of the whole genus will be found in the "Botanical Gazette" 27:235 (1899), to which the student is referred for fuller descriptions than those given below. F. A. WAUGH.

CULTURE.—In the growing of a large collection of Lilies in the open air, the best results can be obtained only with a variety of soils and conditions. Heavy soils are not suited to many of the Lily tribe. A few species, like *L. superbum, Canadense* and *tigrinum*, may do well in heavy soil, but a light soil with sand and gravel intermixed, one from which any excess of moisture runs off, is much better for a large collection. Drainage is of great importance. The slope of a hill, if not too steep, affords a chance for varied degrees of drainage; the upper portions are suited to such as prefer the driest ground, as *L. Philadelphicum, concolor* and *Washingtonianum*, while at the bottom, if the drainage be good, *L. auratum, testaceum, candidum* and others would thrive. No general rule for the culture could be given for all. A slate ridge seems to be well suited to some Lilies. *L. concolor, Philadelphicum, Grayi*, the varieties of *elegans, Washingtonianum, puberulum, Columbianum, Maximowiczii* and others seem to like such soils, and with deep planting will stand more drought than in lighter soils.



1277. Lilium Neilgherrense. (× ⅓.)

Lilies like some shelter from severe winds as well as midday sun. They do finely among Rhododendrons. The point is not so much to shade the stems and foliage as to keep the ground over the bulbs cool and moist. An open frame is an admirable place for planting Lilies, with 3–4 in. of peat or leaf-mold over the bed, which keeps them cool. Peat is very beneficial also when mixed with the soil about the roots.

The scales of Lily bulbs shrink by exposure to air, and in this way the bulb is weakened. Bulbs with shrunken or flabby outside scales are less valuable than with firm and plump ones. They may be kept in damp soil, boxed tightly for some time, but many of the store bulbs have lost much of their vitality by the time they reach the purchaser. It is not rare for such bulbs to fail to grow until the second season. *L. monadelphum, maculatum* and *Brownii* frequently do not appear above ground until the second season, if their scales have been dried to any considerable degree.

Among the kinds which seem to do well in any ordinary light soils, and which, as a rule, may be grown with least effort, are *L. auratum, Chalcedonicum, candidum, elegans* and its common varieties, *testaceum, maculatum, Henryi, tigrinum, Martagon, Maximowiczii, longiflorum, monadelphum*, and the varieties of *speciosum*. *L. superbum* and *Canadense* are also easily grown and do well with considerable shade. *L. Philippense, Catesbæi* and *Neilgherrense* are not suited to outdoor culture in the North. *L. Nepalense* and *sulphureum* may be grown in Vermont with fairly good results, but should not be allowed to freeze during winter. All Lilies are better if their bulbs are not frozen. Most of them will stand some frost at a good depth, but frost seems to weaken them and Lily diseases attack the weaker plants first.

The Lily blight or disease, which seems to affect Lilies in much the same way that the potato rust does the potato, is more damaging to some species than to others. Those from the Pacific coast seem to be more subject to this disease than the Japan species. The disease is common in our wild Lilies and is sometimes found on them in their natural habitat. In cultivation the disease often ruins flowers, foliage and the stalks of *L. Canadense* without seeming to affect the bulbs. It is common on *L. candidum*, and we now seldom find bulbs entirely free from it. The Bordeaux mixture has been found beneficial in fighting the Lily disease, but the best results are attained by using it as a preventive, applying it to the foliage before any blight appears.

In planting new bulbs, it is well to use ground that has not had Lilies for some years. All stalks and foliage affected by blight should be removed and burned, and blighted bulbs and scales, especially such as are worthless from decay, should be burned, as these may help to propagate the disease.

As a rule, Lilies like a rich soil, but it seems to be the general opinion of all who have had experience in growing them that manures (particularly fresh manures) should not be allowed to come in contact with the bulbs. Many advocate the application of all manures as a mulch, letting the rains carry down their fertilizing ingredients. When the enrichment is not allowed to come in contact with the bulbs, but is placed within the reach of the extended roots from the bulb, well composted manures seem not injurious. Lilies, as a rule, do better when set at considerable depth. They seem to resist drought better, and the bulbs are no doubt kept cooler in hot weather. Most Lilies throw out many roots along their stems between the top of the bulb and the surface of the soil, and deep setting is rather necessary to this root-growth. Deep spading should go with deep setting, and it is not too much to say that the ground should be spaded twice as deep as the bulbs are placed. Sphagnum moss has been found beneficial to some species. Among such are *L. auratum* and *candidum*. Two or three inches of the fresh moss may be placed under the bulbs. It has been used with success under others, and is especially good for *L. testaceum*.

Lilies are propagated from seed, from scales and from offsets. With one or two exceptions, the production of bulbs from seed is a very tedious process. Several species seldom, if ever, produce seed in this country. Among these may be mentioned *L. candidum, speciosum, testaceum, maculatum, Brownii, tigrinum, Chalcedonicum*, and some varieties of *elegans*. Some species, such as *L. auratum*, seldom germinate until the second summer after planting. *L. tenuifolium* is, however, an exception to most species, for not only does the seed germinate the first year, but it is not rare for some of the bulbs to bloom the second summer.

In growing Lilies from scales, it is a good plan to remove outside scales from strong bulbs when quite ripe or in early spring, and plant these scales where they will be kept moist and warm. They generally change into bulblets the first season and make a fairly good growth by the second autumn. If well cared for they are large enough to sell by autumn of the third season. *Lilium tigrinum, bulbiferum* and *sulphureum* have bulblets in the axils of their leaves, which, if gathered as soon as mature, may be planted, and with good care usually bloom the third or fourth year. In many other kinds offsets form along the stems beneath the surface and down to the bulb, which, when planted out, make good bulbs in about 3 years.

Lilium longiflorum, Maximowiczii, especially the red variety, and most of the varieties of *elegans*, have a large number of offsets along their stems under the surface of the ground. The number is larger in seasons when plenty of rain comes during their growth than in dry seasons. *L. candidum* is set with best results as soon as the foliage begins to turn in August; and it is at this ~~same~~ season that its scales should be planted for propagation. When good, healthy scales of this species are planted out early, they usually change the same autumn into bulbs, and most of them will send up leaves before winter.

F. H. HORSFORD.

LILIES IN CANADA.—Some of the species generally recommended for garden culture as hardy do not stand at Ottawa. Those that have failed are *L. candidum* (of late years from disease), *Krameri, cordifolium, speciosum, Krætzeri, Canadense, Harrisii, auratum*, and vars. *pictum, platyphyllum, hyemale, Wittei*. Those that have held their own, but have not increased, are *L. Maximowiczii, pomponium, Pyrenaicum, elegans semi-pleno* and *elegans incomparabile*. Those that have increased and been perfectly hardy are *L.* **longiflorum*, **Brownii*, **croceum*, **Batmanniæ*, **Wallacei, maculatum*, **Dahuricum, elegans* and vars. **citrinum* and others, *L.* **tigrinum, tigrinum*, var. *Fortunei* and *flore-pleno*, *L. speciosum* vars. **album*, **roseum, rubrum* and **Melpomene*, *L.* **Martagon*, **superbum*, **pardalinum*, **testaceum*, **pomponium*. Those starred (*) are the most satisfactory. It would be well to warn growers that in the average garden *L. auratum*, in all its varieties, will not last more than 2 or 3 years without renewing. Some of the more expensive varieties flower only once.

An important characteristic of Lilies is perfume, a point in which they differ very much. It is very strong in *L. candidum, longiflorum* and the *auratums*, and the atmosphere is full of the delicious odor on a quiet evening. It is fainter in *L. testaceum*, and rank in *L. croceum* and related species, and a positive stench in *L. pomponium*—almost unendurable in the garden and unbearable in the house. Beautiful as *L. pomponium* is in color and habit, the odor outweighs these good points, and makes it undesirable and not to be recommended.

R. B. WHYTE.

THE EASTER LILY.—In North America a tall and large-flowered form of *Lilium longiflorum*, and one that can be readily forced in a relatively high temperature, has come to be known as the Easter Lily. This variety was introduced from Bermuda. About 1875, a Philadelphia woman, in returning from Bermuda, brought with her two Lilies in bloom and presented them to a local florist. The bulbs were increased to one hundred in the next three or four years, when the plants were seen by W. K. Harris, an enterprising Philadelphia florist. The earliness of blooming and prolificacy of the bulbs were striking features, and led to their purchase by Mr. Harris. In 1882, the Lily was introduced under the name *Lilium Harrisii*. It had been exhibited previously in New York and Philadelphia, where its early flowering brought it into prominent notice. While the Lily was being increased prior to its introduction, other florists who had seen it were gathering bulbs in Bermuda and endeavoring to secure a stock. In 1882, it was also introduced by a Philadelphia florist under a long Latin name, and later by a New York florist as the Bermuda Easter Lily. Practically all of the names except *Lilium Harrisii* have been discarded. To botanists it is known as *L. longiflorum*, var. *eximium*. The distinguishing trait of *L. Harrisii*—and this gives it its emphatic commercial value—is its power to stand a high temperature, allowing it to be forced into bloom

1278. Lilium Japonicum (× ½).

throughout the winter. A second favorable feature is the production of an unusually large number of flowers from each bulb, and a third, the large size of the flowers. It is practically impossible to obtain uniform and good stock of the true variety from Bermuda at the present time.

The propagation and general management are not unlike that given other bulbs of its class. It is multiplied by offsets, in which the variety is prolific, a bulb sometimes producing as many as fifty. When first introduced, the stock was increased from the bulb scales, and from cuttings of the stem before the plant had bloomed.

1279. Lilium Philadelphicum (× ⅓).

The Easter Lily is not difficult to grow under glass, if one has strong and healthy bulbs. The perplexity in its culture, of which one sometimes hears so much, is due to the fact that bloom is usually wanted at definite seasons, as New Year's, Easter, Decoration Day. Now, the time at which any bulbous plant will bloom depends to an important extent on the age, size, freshness and degree of maturity of a given bulb. Each bulb is to a great degree a law into itself. This explains why it is so difficult to secure uniform bloom at a definite time. The dates of potting and shifting which give satisfactory results one season may give unsatisfactory results the following season. What the gardener does, therefore, is to start his bulbs early, and then retard or force them by varying the temperature, as the crop and occasion may demand. He grows them in pots, so that he may shift them from house to house.

In common with all hardy or spring-blooming bulbs, Easter Lily bulbs should be kept cool until roots have formed, when they may be brought into heat for flowering. Secure the bulbs as early as possible. Place your order in early summer. You will do well if they are received in early September. Keep them moist: if they become dry and shrivelled, much of their vigor is lost. There are three leading commercial grades, measured by the average circumference in inches of the bulbs,—the 5–7's, 7–9's, 9–11's. The 7–9 is usually the most serviceable and economical grade for the commercial florist. It is best to put them into small pots (usually 4 in.) to form roots, and to transfer them, when growth has begun, to the pots in which they are to bloom. Handling them at first in small pots saves labor, economizes room, and may give stockier plants. By growing them in pots, the plants may be shifted from cool to warm parts of the house, thereby insuring greater uniformity of season; and all diseased plants are readily detected and easily discarded.

In September or October, then, the bulbs are firmly potted. If the soil is rather heavy, set the bulb on a cushion of sand (see Fig. 290, p. 192). The top of the bulb should be about level with the surface of the soil. The best earth is one which is light and rather fibrous, devoid of clay. A good potting soil (see *Potting*) will answer. The 5–7 and 7–9 sizes may be put in 4- or 4½-inch pots, and the 9–11 in 5-inch. Plunge them in a frame in the open, covering with sifted coal ashes or excelsior; or put them in a cool cellar. Here they may remain (in New York) until the 10th or 15th of December. Protect them from very severe weather and from beating rains. By early December they should have made good balls of roots, and a little top growth. Bring them in, and shift into 6-inch or 7-inch pots, one bulb in each. For decoration, 3 to 5 small bulbs may be put in 8- to 10-inch pots, choosing bulbs of equal strength in order that the bloom may be simultaneous. None of them will need transferring again. For early results for cut-flowers, it is customary to put the 5–7 bulbs at first into 5-inch pots and to put them at once on the benches, keeping them rather cool for a time. Flowers may then be secured for the holidays.

Keep them cool. A carnation temperature suits them well until they begin to bloom, when a higher temperature is desirable. Start with a night temperature of 45° to 50°, increasing to 60°. If the flowers begin to open too soon, remove to a cooler house which is partially shaded, where they may be retarded as much as two weeks. If they are too late, give more heat. The electric light run at night will hasten the bloom perceptibly. Rarely can more than 80 or 90 per cent of a crop be made to bloom simultaneously. Following are the dates of a crop which was forced for Easter (at Cornell):

October 9. Bulbs received and potted, and plunged in frames.
December 11. Brought into house.
December 12. Shifted to permanent pots, and plunged in a bed in a house having night temperature of 50°.
February 5. First buds seen; some of the pots transferred to a warmhouse (temperature for tomatoes).
March 20. Plants in bloom in warmhouse.
April 15. Easter. Plants in full bloom in coolhouse.

Give Easter Lilies plenty of light. Keep down the aphis by fumigating with nicotine vapor once a week. If the bugs get a start, give them a little very weak tobacco water. Stake the plants when about 2 feet high. A good plant from a 7–9 bulb should have 3 to 5 flowers open at once, and 1–3 buds. After flowering, the bulbs are practically worthless. They may be planted in the border and may give a few flowers that season; and if well protected they may give some satisfaction for several seasons. If the bulbs are to be planted in the border, ripen them up in the pots by gradually withholding water. In rare cases they have been forced again the second winter, but the attempt is not to be advised except for experiment.

All the above remarks are intended for the true Easter or Harrisii Lily. Lately *L. longiflorum* itself has come into use for greenhouse work. It is usually more uniform, of lower growth, and a neater plant. It does not force so well, however, and is usually difficult to get for an early Easter. It should be in prime for Decoration Day. Some of these Longiflorums come from Bermuda and others from Japan. The Bermuda-grown Lilies are less reliable than formerly. It is probable that Cuba and the southern parts of the U. S. will grow the stock in time.

L. H. B.

The genus Lilium is distinguished by having flowers with the perianth of 6 distinct segments, deciduous, clawed, the claws usually distinctly grooved; stamens

6, equal, slightly adhering to the ovary below; anthers attached near the middle, dehiscent along the edges; style clavate, more or less curved: ovary sessile or nearly so, 3-celled, with many horizontal ovules. Succulent herbaceous plants, with scaly bulbs and leafy, upright stems: lvs. scattered or whorled: fls. showy, solitary, umbellate or racemose.

Subgenus I. EULIRION. Perianth funnel-shaped, with oblanceolate segments, which are recurved only at the tip: lvs. linear or lanceolate, sessile or nearly so.

Subgenus II. ISOLIRION. Fls. usually single or umbellate; perianth erect, spreading; segments recurved only in the extended flower, but not revolute; stamens diverging from the straight style.

Subgenus III. ARCHLIRION. Perianth broadly funnelform at the base; segments finally broadly spreading or twisted, revolute, usually prominently papillose within; stamens diverging from curved style.

Subgenus IV. MARTAGON. Fls. strongly nodding, with perianth segments very revolute; stamens diverging; style curved.

Subgenus V. PSEUDOMARTAGON. Inflorescence usually paniculate, with fls. tending to be erect or only slightly nodding; perianth funnelform; segments slightly recurved at the tip, or finally recurved from the middle. American species.

Subgenus VI. CARDIOCRINUM. Lvs. stalked, cordate-ovate: perianth funnel-shaped, usually more or less irregular; segments oblanceolate, recurved only at the apex.

INDEX.

album, 22, 25.
Alexandræ, 6.
alutaceum, 17.
angustifolium, 28.
Armeniacum, 17.
atrosanguineum, 17.
aurantiacum, 15, 17.
auratum, 21.
autumnale, 27.
Batmanniæ, 17.
bicolor, 17.
Bloomerianum, 24.
Brownii, 7.
bulbiferum, 15.
Californicum, 24, 28.
Canadense, 36, 37.
candidum, 8.
Carolinianum, 27.
Catesbæi, 18
Chalcedonicum, 33.
citrinum, 17.
Colchesteri, 6, 7.
Colchicum, 29.
Columbianum, 23.
concolor, 14.
cordifolium, 38.
coridion, 14.
croceum, 16.
Dahuricum, 13, 17.
Dalhansoni, 25.
Dalmaticum, 25.
Davuricum, 13.
elegans, 17.
excelsum, 31.
eximium, 5.
formosum, 17.
Fortunei, 10.
fulgens, 17.
giganteum, 30.
Grayi, 35.
hæmatocrorum, 17.
Harrisii, 5.
Hansoni, 26.
Heldreichi, 33.
Henryi, 20.
Humboldtii, 24.
Isabellinum, 31.
Japonicum, 6.
Krætzeri, 22.
Krameri, 6.
lancifolium, 22.
Ledebouri, 29.
Leichtlini, 30.
leucanthemum, 7.
Lishmanni, 19.
Liu Kiu, 5.
longiflorum, 5.
maculatum, 8, 26.
Martagon, 25.
Masseyi, 13.
Maximowiczii, 30.
Melpomene, 22.
monadelphum, 29.
montanum, 13.
Neilgherrense, 4.
Nepalense, 9.
ochroleucum, 3.
pardalinum, 28.
Parryi, 11.
partheneion 14.
parviflorum, 23.
parvum, 36.
Philadelphicum, 13.
Philippense, 1.
plenescens, 19.
pleno-monstrosum, 18.
pomponium, 32.
præcox, 22.
Pseudo-tigrinum, 30.
puberulum, 24.
pulchellum, 14.
purpureum, 12.
Pyrenaicum, 32.
roseum, 6.
rubellum, 10.
rubescens, 12.
rubrum, 22, 32.
sanguineum, 17.
Sayi, 23.
Sinicum, 14.
speciosum, 8, 22.
spicatum, 8.
splendens, 19.
striatum, 8.
sulphureum, 3.
superbum, 27.
Szovitzianum, 29.
Takesima, 5.
tenuifolium, 34.
testaceum, 31.
Thunbergianum, 17.
tigrinum, 19.
umbellatum, 17.
Walkeri, 36.
Wallacei, 17.
Wallichianum, 2.
Warei, 28.
Washingtonianum, 12, 28.
Wilsoni, 5.
Wittei, 21.

SUBGENUS I. EULIRION.

A. *Tube scarcely widened from base to middle.*
B. *Lvs. linear. 1-nerved.*
C. *Height 2 ft. or less* ..... 1. **Philippense**
CC. *Height 3 ft. or over.*
D. *Fls. white; anthers yellow* .... 2. **Wallichianum**
DD. *Fls. purplish or yellowish; anthers brown* .... 3. **sulphureum**
BB. *Lvs. lanceolate, 3-nerved or more.*
C. *With creeping subterranean stem* .... 4. **Neilgherrense**
CC. *Stem usually erect from the bulb*.............. 5. **longiflorum**
AA. *Tube widening gradually from base to neck.*
B. *Lvs. narrow-lanceolate, 1-nerved, not whorled.*
C. *Fls. white or pink*...... 6. **Japonicum**
CC. *Fls. purplish, especially outside*........ 7. **Brownii**
BB. *Lvs. broad lanceolate, 3-7-nerved, not whorled.*
C. *Fls. in spike, usually white* .... 8. **candidum**
CC. *Fls. few or solitary, yellowish or purplish*... 9. **Nepalense**
CCC. *Fls. few or several, pink*.10. **rubellum**
BBB. *Lvs. in whorls.*
C. *Fls. clear lemon-yellow*.11. **Parryi**
CC. *Fls. whitish or pinkish or spotted*............12. **Washingtonianum**

1. **Philippénse**, Baker. Bulb perennial, ovoid: stem 1½-2 ft. high, slender, erect: lvs. 30-40, scattered: fls. solitary, horizontal, white, tinged with green toward the base outside, 5-6 in. long, trumpet-shaped. Philippine Islands. El. 3. Gn. 50:1097 (fine). B.M. 6250 (good). I.H. 41:16.—Little known in cult., but a promising species.

2. **Wallichiànum**, Schult. f. Bulb large, long: stem 4-6 ft. high, stiff: lvs. 50-60, scattered, sessile, 3-5-nerved: fls. usually solitary, sometimes 2-3, horizontal or nearly so, white, slightly tinged with green, fragrant. Central Himalayas. El. 4. B.M. 4561. Gn. 10:44.—Somewhat difficult to grow, and on that account not popular; but a noble species well worth the pains of the amateur. Suitable for growing in shrubbery borders.

3. **sulphùreum**, Baker. Bulb large, globose: stem erect, 4-8 ft. high: lvs. numerous, scattered, linear: fls. usually 2-3, pendent on long peduncles, fragrant, sulfur-yellow, tinged with red outside, 4-7 in. long. Burma. B.M. 7257. Gn. 54, p. 259 (as *L. ochroleucum*). R.H. 1895:541.—This is new to the trade, but promises to be a favorite with the amateurs.

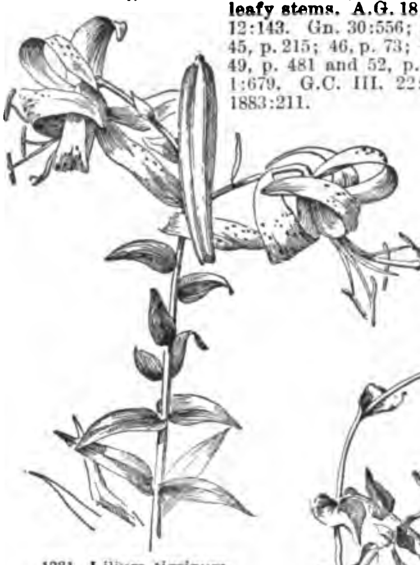
4. **Neilgherrénse**, Wight. Fig. 1277. Bulb globose: stem 1-2 ft. high, creeping at the base: lvs. 30-40, crowded, 3-5-nerved: fls. 1-3, ascending, white, fragrant, 5-6 in. long. India. El. 6. F.S. 22:2266-67. Gn. 27:488. B.M. 6332. F.M. 1876:237.—A beautiful Lily, too little known in America. Difficult of cultivation.

1280. Lilium elegans (× ¼). No. 17.

5. **longiflòrum**, Thunb. Bulb globose: stem 1-3 ft. high, erect: lvs. 20-40, scattered: fls. often solitary, sometimes 2-3 or more, nearly horizontal, fragrant, waxy white. Temperate regions of Japan, China and Formosa.

El. 7. A.F. 11:1311; 12:1104. B.R. 7:560. L.B.C. 10:985. A.G. 19:709. Gn. 48, p. 386.—One of the best-known Lilies in cult. It has been used extensively for forcing, but for this purpose it is now generally superseded by the following variety:

Var. **eximium**, Nichol. (*L. eximium*, Court. *L. Hárrisii*, Carr.). BERMUDA OR EASTER LILY. Usually bears more and larger flowers than *L. longiflorum*, on more leafy stems. A.G. 18:297. A.F. 12:143. Gn. 30:556; 43, p. 165; 45, p. 215; 46, p. 73; 47, p. 172; 49, p. 481 and 52, p. 217. F.R. 1:679. G.C. III. 22:91. R.H. 1883:211.

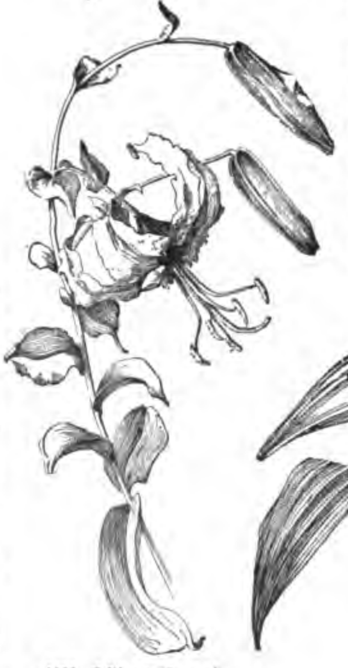


1281. Lilium tigrinum. (×1-5.) No. 19.

Vars. **Takésima, Wilsoni** and **Liu Kiu** are offered. They are not sufficiently different from the type for ordinary cultivation.

6. **Japónicum**, Thunb. Fig. 1278. Bulb globose: stem 1–3 ft. high: lvs. 12–20, scattered, lanceolate, 5–7-nerved: fls. often solitary, sometimes 2–3, white on the inside, more or less tinged with pink or purple on the outside, fragrant, 3–5 in. long. Japan. El. 14. B.M. 1591. L.B.C. 5:438.—A fine, graceful species, much grown in gardens. There are several varieties, of which (excepting *roseum* below) **Alexándræ** and **Cólchesteri** are the best. G.C. III. 14:243.

Var. **róseum**, Hort. (*L. Krámeri*, Hort.). More slender and graceful than *L. Japonicum*, with beautiful pale rose-colored fls. B.M. 6058. F.M. 1874:105. F. 1874:13. F.S. 20:2061.—One of the most attractive flowers in the genus.



1282. Lilium Henryi. (× ¼.) No. 20.

7. **Brównii**, Poit. (*L. Japonicum*, var. *Brownii* of many writers). Differs from *L. Japonicum* in having a more robust, vigorous habit, with leafy stalk and large fls., which are white inside and deep rich vinous purple outside. El. 8. Gn. 29:540 (as *L. Japonicum*); 38, p. 173; 47, p. 97. F.S. 21:2248, 2193 (as *L. Japonicum Colchestrii*). Gng. 4:193.—A favorite in gardens, and deserving of general culture. Specially recommended to beginners. Var. **leucánthemum** is offered. Gn. 47:1000.

8. **cándidum**, Linn. MADONNA LILY. Bulb ovoid, large: stem-lvs. scattered, sessile, acute, bract-like above: stem 2–4 in. high, erect, stiff: fls. 6–25 in a raceme, 3½–5 in. long and wide, pure white, fragrant. Southern Eu. El. 9. Gng. 6:369. G.C. III. 21:161. Gn. 45, p. 281: 53, p. 188; 56, p. 255.—One of the most ornamental species, and an old favorite, though considerably subject to disease. The following varieties are offered: **fl. pl., maculàtum, pleno-monstròsum, speciòsum, spicàtum, striàtum.**

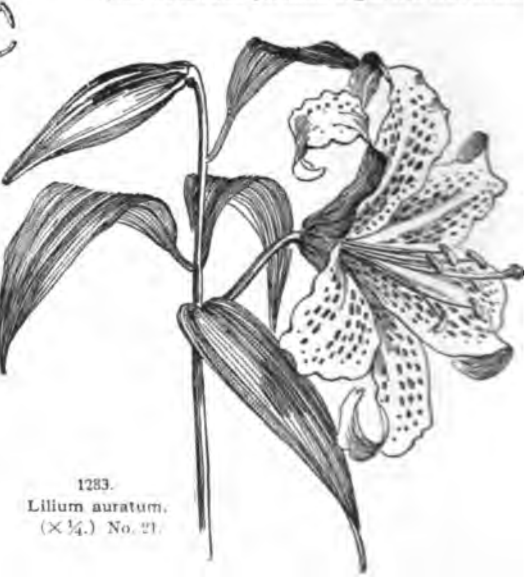
9. **Nepalénse**, D. Don. Stem 1–2 ft. high, stiff: lvs. scattered, lanceolate or linear, 5–7-nerved: fls. few or solitary, nodding, slightly fragrant, yellowish white, more or less tinged with purple, often with small scattered dots inside. Himalayas. El. 5. A.G. 13:249 (poor). Gn. 35:684. B.M. 7043. R.B. 22:3.—A magnificent Lily, suitable for the collector.

10. **rubéllum**, Baker. Bulb globose: stem slender, bearing about 20 obscurely petioled bright green lvs., which are 5–7-nerved: fls. pink, unspotted, about 3 in. long and broad. Japan. Gn. 54:1197. G.C. III. 23:321 and 335. G.M. 41:477. A.G. 20:31.—Recently introduced to English and American gardens, and very favorably received. Promising. Said to force well.

11. **Párryi**, Wats. Bulb small, with jointed scales: lvs. linear-oblanceolate, usually scattered: fls. horizontal, pale yellow, about 4 in. long, with spreading, recurved tips. San Bernardino county, Calif. El. 12. Gn. 18:264 (not typical); 49, p. 410. B.M. 6650. I.H. 33:595. G.C. III. 18:209 (habit not correctly shown).—Not uncommon in cult., and probably the finest yellow Lily of easy growth.

12. **Washingtoniànum**, Kellogg. Bulb oblique, somewhat rhizomatous: stem 2–5 ft. high: lvs. in several whorls of 5–12 each, or sometimes a few scattered: fls. few, or sometimes as many as 20, on ascending pedicels, white, tinged with pink or red and dotted with purple, fragrant. Calif. El. 10. Gn. 20:310; 27, p. 344. J.H. III. 33:113.—One of the best Californian species for eastern gardens.

Var. **purpùreum**, Mast. (*L. rubéscens*, Wats.). Smaller and more slender, with smaller, more pinkish fls. and perianth segments less acute. El. 11. F.S. 19:1975. .Gn. 20:310.—A striking variety which should perhaps be regarded as a separate species.



1283. Lilium auratum. (× ¼.) No. 21.

SUBGENUS II. ISOLIRION.

A. *Lvs. more or less whorled*.......13. **Philadelphicum**
AA. *Lvs. not whorled.*
  B. *Style shorter than ovary*.....14. **concolor**
  BB. *Style longer than ovary.*
    C. *Fl. papillose inside.*
      D. *Stem frequently bulbiferous*................15. **bulbiferum**

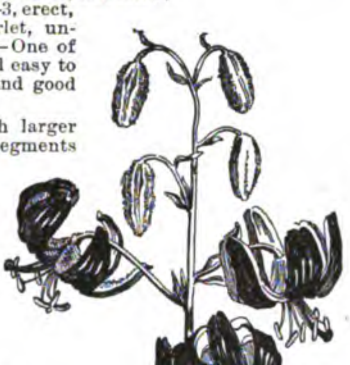
DD. ***Stem not bulbiferous***...16. **croceum**
CC. ***Fl. smooth inside, or nearly so.***
D. ***Lvs. broad lanceolate, crowded***.............17. **elegans**
DD. ***Lvs. linear, scattered***..18. **Catesbæi**

13. Philadélphicum, Linn. Fig. 1279. Bulb annual, rhizomatous, small, with few thick, brittle scales: stem 1–3 ft. high, slender: lvs. 10–40, thin, glabrous, more or less whorled: fls. 1–4, terminal or umbellate, bright red, marked with scattered darker spots toward the center. From Canada to N. C. and west to the Rocky Mts. El. 17. B.R. 7:594. L.B.C. 10:976. B.M. 872 (as Pennsylvanicum) and 579. G.W. F. A. 6.—*L. montanum*, Nelson, seems to be a western form, with broader lvs. *L. Masseyi* is a southern form, with narrower perianth segments. This is the most characteristic and widely distributed of our native Lilies. A charming wild flower. In fact, it is so acceptable simply as a wild flower that it has seldom been cultivated, though it takes readily to the garden. It is a very variable species. Some, at least, of the *L. Davuricum*, or *L. Dahuricum*, in the nursery trade belongs with *L. Philadelphicum*.

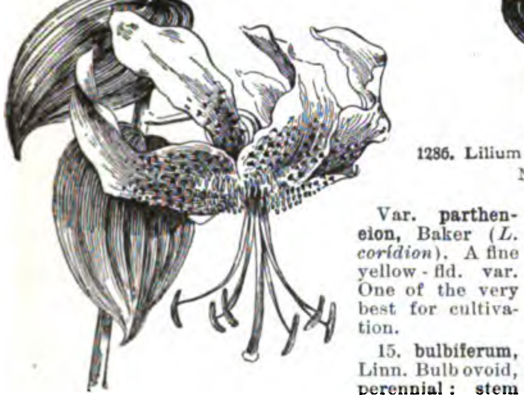
14. **cóncolor,** Salisb. Bulb perennial, ovoid, small: stem slender, 1 ft. or more high: lvs. 20–30, scattered, lanceolate, obscurely 7-nerved: fls. 1–3, erect, 1–2 in. long, spreading, bright scarlet, unspotted. China. El. 18. B.M. 1165.—One of the best for garden cult.; thrifty and easy to grow. Of graceful, upright habit and good for cutting.

Var. **Sínicum,** Hook. Taller, with larger bulb: fls. more numerous; perianth segments a little wider, bright scarlet with black spots. Southern Siberia. B. M. 6005. L.B.C. 17:1628 (as *L. Buschianum*).

Var. **pulchéllum,** Baker. A slender yellow-fld. var., perhaps belonging with the next.



1286. Lilium Martagon (× ¼). No. 25.

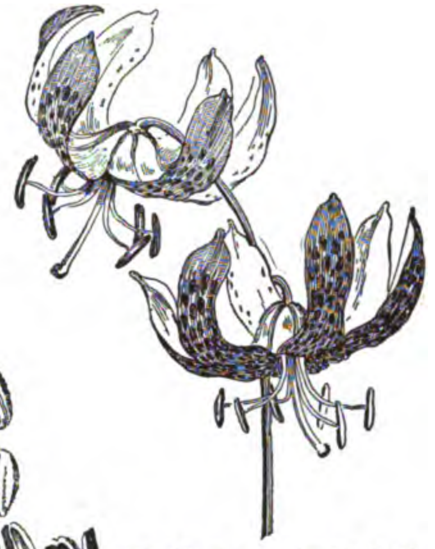


1284. Lilium speciosum (× ¼). No. 22.

Var. **parthenéion,** Baker (*L. corídion*). A fine yellow-fld. var. One of the very best for cultivation.

15. **bulbiferum,** Linn. Bulb ovoid, perennial: stem 2–4 ft. high: lvs. scattered, the upper ones often bearing bulbils in the axils: fls. 1 to many, umbellate or somewhat racemose, on short, stout pedicels; perianth 1½–2 in. long, erect, spreading, bright red or dark orange, usually with some dull spots, papillose toward the center. Cent. Eu. El. 23. B.M. 36. —This is one of the oldest in cult., and has run into many horticultural varieties, few of which, however, are known in this country. The only one named in American trade catalogues is **aurantiacum.** In Europe the species seems to be more commonly cultivated.

16. **cróceum,** Choix. Bulb perennial, globose: stem 2–4 ft. high, vigorous: lvs. numerous, crowded, linear or lanceolate, 3–5-nerved, not having bulbels in the axils: pedicels ascending, white-cobwebby: fls. solitary, or 10–15, in an umbellate raceme, erect, funnelform, 2½–3 in. long, bright orange, conspicuously lamellar-papillose inside. Switzerland, France, northern Italy. Much cult., especially in Eu. El. 22. L.B.C. 8:784 (poor).—Closely related to *L. bulbiferum*, with which it is often confused. It seems to be confounded with *L. elegans*, also, at times. It is distinguished from the former by having stems devoid of bulbels, and from the latter by having the flower more distinctly papillose inside.



1285. Lilium puberulum (× ⅓). No. 24.

17. **élegans,** Thunb. (*L. umbellàtum*, Hort., not Pursh. *L. Dahùricum*, in part. *L. Thunbergiànum*, Schultes, and many other synonyms). Fig. 1280. Bulb perennial, ovoid: stem 1–2 ft. high, stiff, erect, slightly cobwebby, or sometimes nearly glabrous: lvs. 20–30, scattered or crowded, 5–7-nerved: fls. 1–5, spreading, usually self-colored in some brilliant shade of yellow, orange or red. Japan. Sundry varieties are illustrated as follows: El. 19 and 20. Gn. 47, p. 415. F. 1868:121. F. S. 16:1627 as (*L. Thunbergianum*). Gn. 38:778. P. M. 6:127 (as *L. aurantiacum*). I. H. 12:459 (as *L. formosum*).—Probably the most useful hardy species for general garden use. Very variable, with many striking varieties. Following are the best:

Var. **fúlgens,** Baker (*L. Bátmanniæ*, Wallace. *L. fúlgens*, Morren. *L. sanguineum*, Hort.). A fine orange or salmon-red var., with perianth segments rather narrower than the type. One of the finest Lilies for color-massing. Thrifty and clean in the garden. Var. **atrosanguineum,** Bak. & Dyer. Very deep dark red. I.H. 14:503 ! (as *L. hæmatocroum*). Var. **alutàceum,** Bak. & Dyer (var. *Armeniacum*, var. *citrinum*, etc.). More or less clear yellow. F.S. 22:2319. Var. **bicolor,** Moore. Yellow at the center and reddish outwards. Var. **plènus,** Waugh. More or less double. F. 1871, p. 83. Var. **Wállacei,** Waugh (*L. Wallacei*). Small, dwarf, usually 1-fld., pale red; segments rather acute. There are dozens of other horticultural varieties, among which the best are Alice Wilson, Best Red, Incomparable, Van Houtte. These varieties are rather more distinct than in most species of Lilies.

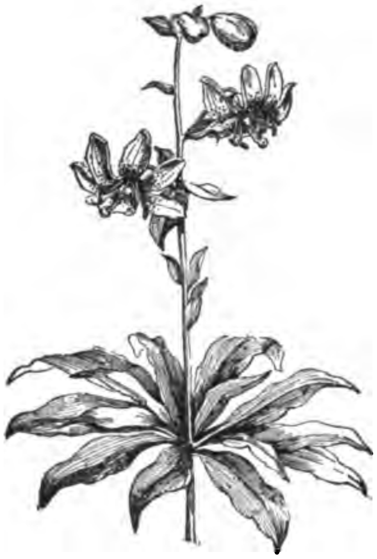
18. **Cátesbæi,** Walt. Bulb like that of *L. Philadelphicum:* stem 1–2 ft. high, slender, erect: lvs. 20–30, scattered, lanceolate: fls. usually solitary, erect, bright orange red, spotted; segments lanceolate, with long-attenuate tips. N. Car. to Fla. and west to Ky. El. 25. B.M. 259 (good). L.B.C, 9:807. R.H. 1868:431 (poor).—

A pretty plant, but not successful in cult., at least not in the northern states.

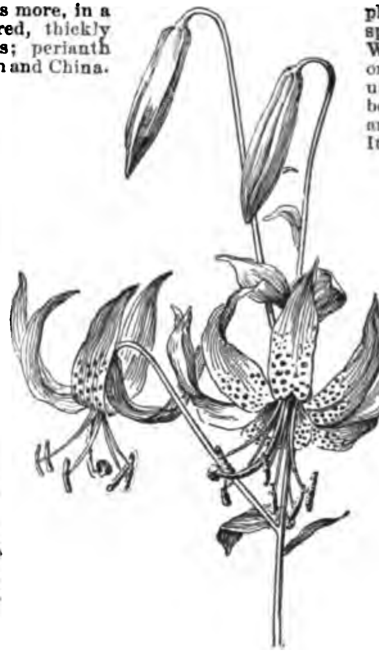
SUBGENUS III. ARCHLIRION.

A. *Lvs. sessile*..........................19. **tigrinum**
AA. *Lvs. short petiolate.*
  B. *Fls. dull reddish*...............20. **Henryi**
  BB. *Fls. white, yellowish, or pinkish.*
    C. *Fls. open funnelform, on rather short, straight pedicels*...................21. **auratum**
    CC. *Fls. on long, twisted pedicels; segments twisted revolute*....................22. **speciosum**

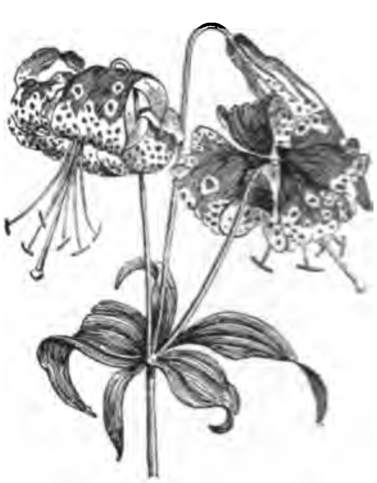
19. **tigrinum**, Andr. TIGER LILY. Fig. 1281. Bulb perennial, globose: stem 2–5 ft. high, somewhat whitish cobwebby: lvs. scattered, rich green, 5–7-nerved, the upper ones shorter and bearing bulbels in their axils: fls. 3–10, or sometimes more, in a wide raceme, nodding, bright red, thickly spotted with large purplish spots; perianth segments twisted, revolute Japan and China. El. 38. B.M. 1237. F. 1873:13.—A thoroughly old-fashioned and remarkably useful plant. It lives and thrives from year to year in the open border, where it should be planted in masses.



1287. Lilium maculatum (× 1·5). No. 26.



1288. Lilium superbum (× ⅓). No. 27.



1289. Lilium pardalinum (× ¼). No. 28

Var. **spléndéns**, Leicht. A fine variety of more robust habit, with longer-flowering spikes. Gn. 27:480 and p. 152. F.S. 19:1931 (too dark colored). This is to be highly recommended. In most gardens it should be substituted for the ordinary Tiger Lily.

Var. **plenéscens**, Waugh. An odd double var. R.H. 1873:10 (good). F. 1871:25. F.S. 19:1995. Other vars. are **Fórtunei** and **Lishmanni.**

20. **Hénryi**, Baker. Fig. 1282. Bulb globose: stem 2–6 ft. high: lvs. lanceolate below, more ovate above: inflorescence a lax corymb of 4–8 fls., bracteate at the base: fl. dark reddish yellow, marked with a few irregularly scattered brown spots. Ichang, western China. Gn. 40:830 (fine); 55, p. 233 (fine). G.C. III. 8:380. B.M. 7177 (too light-colored).—Recently introduced to cult., and unquestionably one of the best Lilies known for general garden culture. The price of the bulbs still keeps many persons from planting it, and many others from massing it in large quantities, as it should be used for the best effect. Still it propagates so freely and proves so hardy that it will undoubtedly soon become cheaper, and find its way into common use. In habit and general appearance, it stands midway between *L. tigrinum* and *L. speciosum*. Its free and easy unconventionality of habit will endear it to the heart of the artist flower-lover. In this respect, it surpasses even *L. speciosum*.

21. **auràtum**, Lindl. GOLD-BANDED LILY. JAPAN LILY Fig. 1283. Bulb perennial, globose: stem 2–4 ft. high: lvs. 20–30, scattered, 5-nerved: fls. in a short raceme, with bracteolate pedicels, spreading; segments much reflexed and somewhat twisted, white, more or less marked with bands of yellow and spots of purple, strongly papillose. Japan. In sundry varieties illustrated as follows: Gn. 15:183; 16:212; 39, p. 455; 50, p. 148. R.B. 21:25. F.M. 1871:514. R.H. 1875:10; 1867:371. El. 15. B.M. 5338. A.G. 20:525. A.F. 7:43. Gng. 2:167; 4:53. G.C. III. 25:303.—Several garden varieties have been described with botanical names, though none seems to be equal to the distinction. Trade varieties are: **imperiàle, macránthum, píctum, platyphýllum, rubro-vittàtum, rùbrum, speciòsum, virginàle, virginàle album, Wittei.** The Gold-banded Lily is a favorite in American gardens, where it is used in large quantities. It appears to best advantage massed and scattered amongst moderately tall-growing shrubs. It is of comparatively easy culture, but does not live and thrive indefinitely, as *L. speciosum*. *Henryi* and *tigrinum* do.

22. **speciòsum**, Thunb. (*L. lancifòlium*, Hort.). Fig. 1284. Bulb perennial, globose: stem 2–4 ft. high, stiff: lvs. 12–20, scattered, very short-petiolate, oblong-lanceolate, 5–7-nerved: fls. 3–10, racemose, on divaricate, bracteate pedicels, white, more or less suffused with pink and dotted with red, strongly papillose toward the center; perianth segments much revolute. El. 13. B.M. 3785. Gn. 25:425; 33, p. 289; 45:947 and p. 90 (fine); 45, p. 91; 47, p. 19. R.H. 1843:492. B.R. 23:2000. This is probably the best species of all for general cult. It is thrifty and hardy, especially var. *rubrum*. The habit of the plant and flower is delightfully free and informal. The white and the red varieties are both grown extensively by the florists, and cut for sale. It has been extensively imported from Japan. There are numerous trade names current, most of which do not stand for important varieties. The ones of greatest concern are **Mel-pómene** and **Kraetzeri.** The Lily known as "Opal" is a form of this species.

Var. **rùbrum**, Hort., is a fine, extra strong growing sort, with darker pinkish red fls., and is the best for garden culture. Gn. 36:726.

Var. **álbum**, Hort. (*L. præcox*, Hort.), is white or nearly so and less thrifty. P.M. 8:127.

SUBGENUS IV. MARTAGON.

A. *Foliage mostly whorled.*
B. *Lvs. in small whorls of less than 8 or partly scattered*...23. **Columbianum**
BB. *Lvs. nearly all in large whorls of 8 or more.*
C. *Bulb large, horizontally elongated*................24. **puberulum**
CC. *Bulb small, globose.*
D. *Fls. purplish or whitish*.25. **Martagon**
DD. *Fls. yellow, spotted*.....26. **maculatum**
DDD. *Fls. mostly reddish or dark orange.*
E. *Color reddish or yellowish, dull black-spotted*.............27. **superbum**
EE. *Color orange-yellow, with distinct round dark spots*..........28. **pardalinum**
AA. *Foliage not whorled.*
B. *Form of lvs. lanceolate; nerves many*......................29. **monadelphum**
BB. *Form of lvs. linear; nerves one or few.*
C. *Lvs. crowded.*
D. *Perianth segments rather broad.*
E. *Fls. red or yellow*....30. **Maximowiczii**
EE. *Fls. creamy white*....31. **testaceum**
DD. *Perianth segments narrow.*
E. *Fls. whitish outside*..32. **pomponium**
EE. *Fls. red outside*......33. **Chalcedonicum**
CC. *Lvs. scattered*..............34. **tenuifolium**

23. **Columbiànum**, Hort. (*L. Sàyi*, Nutt. *L. parviflòrum*, Holz.). Bulb perennial, ovoid, small: stem 1½–3 ft. high, slender: lvs. few, mostly in whorls of 4 or 5, the upper ones frequently scattered, oblanceolate, acute: fls. 2–3 or more, umbellate, on slender nodding pedicels; perianth 1½–2 in. long, bright orange, thickly spotted with small purplish dots; segments lanceolate, reflexed. Ore., Wash. El. 31. F.M. 1874:136, as *L. parviflorum* (not characteristic).—Not uncommon in garden collections, where it succeeds as well as any of the Pacific coast species. It is so slender of stem, sparse of foliage and small of flower, as grown in eastern gardens, that it does not give any mass effect. It looks best mixed in the border with hardy perennials.

24. **pubérulum**, Duchr. (*L. Califórnicum*, Hort., not Domb. *L. Húmboldtii*, Roez. & Leicht. *L. Bloomeriànum*, Kell.). Fig. 1285. Bulb large, thick: stem 3–5 ft. high: lvs. in 4–6 large whorls of 10–15 lvs. each: fls. 6–10 or more, in a large panicle, on nodding, divaricate pedicels, bright orange-red, thickly marked with dark spots; segments strongly reflexed. Calif. El. 32. F.S. 19:1973. Gn. 20:314 and p. 568.—A noble, dignified, commanding plant, and one which ought to be cult. oftener. Rather formal in appearance.

25. **Mártagon**, Linn. (*L. Dalmáticum*, Vis.). TURK'S CAP LILY. Fig. 1286. Bulb perennial, ovoid: stem 2½–5 ft. high: lvs. in 2–4 whorls of 6–9 each, sometimes a few scattered, sessile, with 7–11 nerves: fls. 3–20, in a long, loose, bracteate raceme, nodding, fragrant, varying in color from purple to dirty white, spotted or unspotted; segments lanceolate, strongly revolute. El. 33. Gn. 23:371; 38, p. 393; 44:927 (as *L. Dalhansoni*). B.M. 872 and 1634. F.M. 1874:136. F.S. 20:2127 (as *Martagon Dalmaticum*).—Much cult. in Europe, less in America. It has many horticultural varieties, but the only one in our catalogues is **álbum**. The plant is vigorous, upright and thrifty, with good foliage, but the fls. are small, dull-colored and not showy, as compared with our more popular kinds.

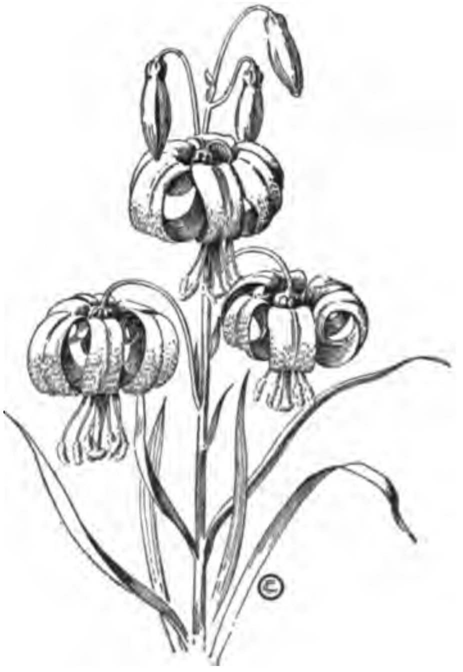
26. **maculàtum**, Thunb. (*L. Hánsoni*, Leicht.). Fig. 1287. Bulb perennial, globose, compact: stem 3–4 ft. high: lvs. oblanceolate, acute, frequently in a single whorl of 8–12, or some scattered, sometimes several whorls: fls. 4–12, in a loose raceme, on erect, spreading pedicels, bright orange, conspicuously spotted with purple on the lower half. Japan. El. 34. B.M. 6126 (good). Gn. 29, p. 287. R.H. 1883, p. 296.—One of the thriftiest and hardiest species known. It is a trifle high-priced for general planting, but is worthy a place in every garden. It is one of the most formal and dignified of Lilies.

27. **supérbum**, Linn. AMERICAN TURK'S CAP LILY. Fig. 1288. Bulb large, globose: stem 3–6 ft., tall, erect: lvs. often in whorls, sometimes more or less scattered, 3–5-nerved: fls. 6–12, or even more, paniculate, bright reddish orange, conspicuously spotted; perianth segments lanceolate, acute. Canada to Georgia and west to the Mississippi river. El. 26. B.M. 936 (good). L.B.C. 4:335 (as *L. autumnale*). Gn. 30, p. 8 (fine); 30:551 (fine); 38:781. Mn. 8:1 (fine).—Frequently cult. Useful in borders.

Var. **Caroliniànum**, Chapm. (*L. Caroliniànum*, Michx.). Smaller, more slender, with fewer fls. and broader lvs. A southern variety, in dry woods, Va. to Fla., and west to La.

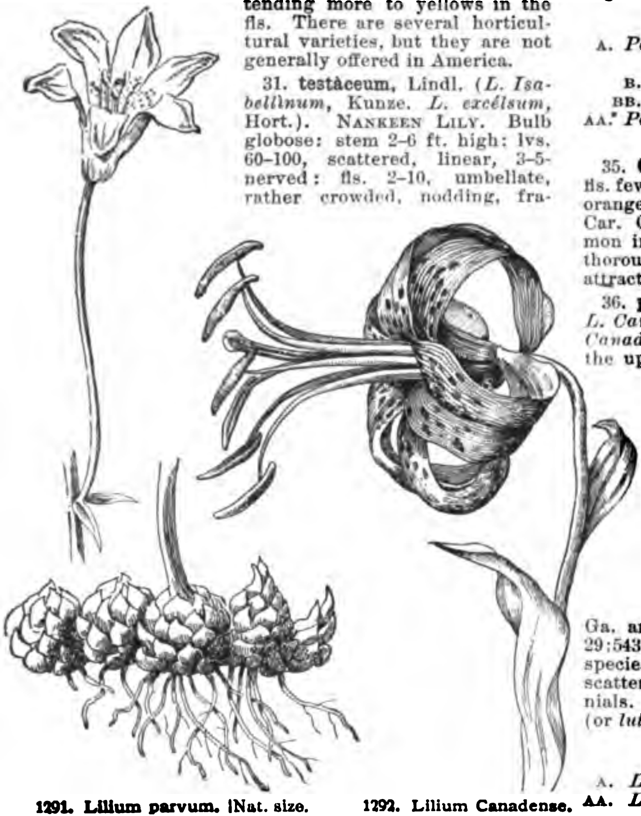
28. **pardalìnum**, Kellogg (*L. Califórnicum*, Domb.). Fig. 1289. Bulb short, rhizomatous: stem 2–3 ft. high: lvs. mostly near the middle of the stem, in 3–4 whorls of 9–12 lvs. each, with a few scattered: fls. 3–10, loose corymbose, on long, nodding pedicels, bright red with orange toward the center, strikingly marked with large purplish brown spots; perianth segments strongly revolute, somewhat papillose. Calif. El. 28 and 29. F.M. 1872:33 (as *L. Washingtoniànum*). Gn. 20:312 and p. 526.—A magnificent garden flower, not commonly grown, though adapted to general cult. Var. **angustifolium**, Kellogg, has narrow, scattered lvs. Var. **Warei**, Hort., has yellow fls. Gn. 29:547.

29. **monadélphum**, Bieb. (*L. Szovitziànum*, Fisch. & Lall. *L. Cólchicum*, Hort.). Bulb perennial, ovoid: stem 2–5 ft. high: lvs. 30–50, scattered, linear-lanceolate or oblanceolate, many-nerved: fls. 2–12, sometimes 20–30, in a raceme, nodding, bracteate, fragrant, yellow, with a few small spots, and tinged at the base and tip with purple. Persia. El. 36 and 37. B.M. 1405. Gn. 9:9 (as *L. Szovitzianum*); 39:796. G.C. III. 16:129.—A pretty species, but not much grown in this country. Var. **Lédebouri**, Baker. Dwarfer than the species, with narrower linear lvs. Caucasus.


1290. Lilium pomponium (× ½). No. 32.

30. **Maximòwiczii,** Regel (*L. Leìchtlini*, Hook. *L. Pseudo-tigrinum*, Carr.). Bulb globose: stem 2–3 ft. high, slender, decumbent at base: lvs. 30–40, scattered, linear, 3-nerved: fls. few, in a loose corymb, on spreading pedicels, bright lemon-yellow, light orange or red, thickly dotted with dark purple and tinged with purple on the outside; segments strongly revolute. Japan. El. 39 and 40. B.M. 5673. I.H. 15:540. R.H. 1867:410. F.S. 17:1736, yellow variety. Gn. 21:331, yellow variety; 42 p. 193 (not typical).—A fine garden plant having much the same habit and cultural qualities as *L. tigrinum*, but tending more to yellows in the fls. There are several horticultural varieties, but they are not generally offered in America.

31. **testàceum,** Lindl. (*L. Isabellinum*, Kunze. *L. excélsum*, Hort.). NANKEEN LILY. Bulb globose: stem 2–6 ft. high: lvs. 60–100, scattered, linear, 3–5-nerved: fls. 2–10, umbellate, rather crowded, nodding, fragrant, creamy yellow, with sometimes a few minute reddish dots. El. 44. B.R. 29:11 (too highly colored). P.M. 10:221.—Not known in the wild state, and generally said to be a hybrid between *L. candidum* and *Chalcedonicum*. If this is a true hybrid it is the only one known in cult. A fine, stately plant, with unusually attractive flowers.



1291. Lilium parvum. Nat. size. No. 36.

1292. Lilium Canadense. An old flower. (×⅓.)

32. **pompònium,** Linn. (*L. rùbrum*, Lam.). Fig. 1290. Bulb ovoid, with several lanceolate scales: stem 2–3 ft. high, thick, stiff: lvs. 100 or more, scattered, narrow-linear: fls. 2–15, racemose, nodding, often bracteolate, cinnabar-red, thickly spotted and papillose within, fragrant. N. Italy and S. France. G.C. III. 8:51. Gn. 20:307 (fine). El. 45.—Adapted to the hardy border, where it shows well in masses or scattered. An excellent Lily for garden planting, especially the yellow var. **aureum,** Hort.

Var. **Pyrenàicum,** Baker (*L. Pyrenàicum*, Gouan). A more robust plant, with wider lvs. distinctly 3-nerved: fls. larger, yellow. Pyrenees. El. 46.

33. **Chalcedònicum,** Linn. Bulb ovoid: stem 3–4 ft. high, stiff: lvs. 100 or more, crowded, 3–5-nerved, with the edges and veins below distinctly papillose: fls. few in a raceme, nodding, bright red, unspotted, or sometimes with minute dots, rarely yellow. Greece. El. 43. F.S. 21:2160. B.M. 30.—An excellent garden plant, and destined to become more popular in America. Here belongs *L. Heldreichi*.

34. **tenuifòlium,** Fisch. SIBERIAN CORAL LILY. Bulb small, globose: stem 1–2 ft. high, slender: lvs. 20–50, scattered, very narrow-linear, with revolute margins: fls. 1–20, racemose, nodding, rich scarlet, self-colored; segments much revolute. Siberia. El. 42. B.M. 3140. L.B.C. 4:358, as *L. pumilum* (poor).—A deserving favorite. Very easily prop. either from seeds or bud scales. Fine for massing. Especially suitable for beginners.

SUBGENUS V. PSEUDOMARTAGON.

A. *Perianth narrow: segments only slightly spreading at the tip.*
  B. *Fls. dull reddish brown* ....35. **Grayi**
  BB. *Fls. bright reddish brown* ....36. **parvum**
AA. *Perianth spreading: segments rotate spreading or slightly recurved*.....37. **Canadense**

35. **Gràyi,** Wats. Lvs. lanceolate, in whorls of 4–8: fls. few or solitary, 1½–2 in. long, dull reddish brown or orange, covered inside with purplish spots. Va. and N. Car. G.F. 1:19. B.M. 7234.—Becoming somewhat common in gardens. Closely allied to *L. Canadense*, but thoroughly distinct as a garden plant. Not showy, but attractive to the amateur. Of easy cult.

36. **párvum,** Kellogg (*L. Canadénse*, var. *Wálkeri*. *L. Canadénse*, var. *párvum*). Fig. 1291. Bulb of *L. Canadense*: stem 1–2 ft. high: lvs. partly whorled, or the upper ones scattered: fls. few or many, upright or nearly so, bright reddish orange, thickly dotted. Sierra Nevada, Calif. El. 30. B.M. 6146. F.S. 21:2192. J.H. III. 31:113 (poor).—A pretty and interesting species, but not sufficiently showy in cult. to suit the average gardener. Var. **flore pleno** is offered.

37. **Canadénse,** Linn. Fig. 1292. Bulb annual, rhizomatous: stem 1–4 ft. high, slender, erect: lvs. oblanceolate, acute, 5–7-nerved, usually mostly in whorls: fls. 1 to several, usually somewhat umbellate, 2–3 in. long, in various shades of yellow, orange and red, with numerous dark spots. Eastern N. A., from New Brunswick to Ga. and west to the Mississippi river. El. 27. Gn. 29:543 (good); 34, p. 182. B.M. 858 (poor).—A good species for garden use. Excellent for massing or for scattering in borders of shrubbery or of hardy perennials. Variable. Var. **rùbrum** has red fls. Var. **flàvum** (or *luteum*) has yellow fls. B.M. 800.

SUBGENUS VI. CARDIOCRINUM.

A. *Lower lvs. tinged with red*.........38. **cordifolium**
AA. *Lower lvs. clear green* ....39. **giganteum**

38. **cordifòlium,** Thunb. Bulb perennial, globose: stem 3–4 ft. high: lvs. at the base cordate, long-petiolate, tinged with red; stem-lvs. cordate-ovate, short-petiolate: fls. 3–10 in a short raceme; perianth narrow, funnelform, 3–5 in. long, white, with large, violet-brown patches on the lower half of the outer segments. Japan. El. 1. G.C. III. 8:41. B.M. 6337.—Sometimes found in collections, but difficult of cult., particularly in this country.

39. **gigantèum,** Wallich. Bulb globose: stem 4–10 ft. high: radical lvs. green; stem lvs. 12–20, scattered, ovate, acute, deeply cordate at base, reticulate veined, petiolate: fls. 12–20 in a raceme, slightly nodding, white, tinged with purple inside and green outside, fragrant, 4–5 in. long. Himalayas. El. 2. G.F. 6:376. B.M. 4673. F. 1874, p. 79 (poor). R.H. 1861, p. 310. I.H. 1, p. 11. G.C. III. 8:47 (good); 16:754. Gn. 8, p. 504 (c. p.); 34, p. 269 (good); 52, p. 226; 54, p. 186 (doubtful).—Found only in large collections. Very difficult of cult.

L. avenàceum, Fisch. One-2 ft. high: lvs. few, scattered or somewhat whorled: fls. few, nodding, small, revolute, bright reddish yellow, with a few fine dots. Gn. 24, p. 85. Japan, Kamchatka and vicinity.—*L. Bakeriànum*, Coll. & Hems. An Indian species not yet in cult. Belongs in subgenus Isolirion.—*L. Bolánderi*, Watson. Bulb ovate: stem 6 in. to 3 ft. high: fls. 1-2, horizontal or slightly nodding, dingy purple or dark brownish red, dark-spotted, about 1 in. long. Calif. Rare. A fine curiosity for the collector, but not a gardener's plant.—*L. callòsum*, Sieb. & Zucc. Bulb small, perennial: stem 1-3 ft.: lvs. 30-40, scattered, linear, 3-5-nerved: fls. 2-12 in a narrow raceme, on short nodding pedicels, bright scarlet. Japan and Loo-Choo Islands.—L. *Carniólicum*, Bernh. Bulb ovoid: stem 2–3 ft.: lvs. 30–40, scattered, many-nerved, with ciliate margins: fls. racemose, nodding, 2 in. long, orange or red. Europe. Rare in cult. El. 45.—*L. Claptonénse*, Hort.=L. primuliuum.—*L. Davidi*, Duch. Known only in herbarium.—*L. Delavayi*, Franchet. A Chinese species recently discovered, and not yet offered for sale. Fls. wine red, somewhat the form of L. longiflorum.—*L. Fargesi*, Franchet. Small, long, yellow fls. Subgenus Martagon. Recently from China, and not yet in the trade.—*L. formòsum*, Franchet. A species recently discovered in China, resembling L. bulbiferum and elegans, but having white fls. Not introduced.—*L. Lankongénse*, Franchet. Newly discovered in Yun-nan, China. Not introduced. Subgenus Martagon.—*L, Lowi*, Baker. A new Burmese species, having 2–3 white fls. somewhat resembling L. candidum. Not yet introduced. B.M. 7232. Gn. 45:953. G.C. III. 14:121.—*L. maritimum*, Kellogg. Bulb small, conical: stem low: lvs. usually scattered, narrow, often obtuse: fls. solitary or few, horizontal, 1–2 in. long, deep reddish orange, spotted. Calif.—*L. medeoloides*, Gray. Stem slender, 1–2 ft.: lvs. several, sometimes whorled, sometimes scattered: fls. 1–3, with short, erect pedicels, funnel-shaped, bright orange-red with a few spots. Japan, Korea. Rare or unknown in cult.—*L. mirábile*, Franchet. A new species of the subgenus Cardiocrinum recently found in Su-Tchuen, China. Not introduced.—*L. myriophýllum*, Franchet. Recently discovered in China. Said to be a "magnificent species, recalling L. Wallichianum." Not yet in the trade.—*L. nítidum*, Hort. Bulb oblong, subrhizomatous, with crowded appressed lanceolate scales: stem 18–24 in. high: lvs. lanceolate, scattered and in whorls: fls. 10–20, bright yellow with many red-brown dots. Not in American gardens.—*L. occidentàle*, Purdy. Bulb rhizomatous: stems 2–4 ft.: lvs. scattering below, but in whorls at the middle of the stem, lanceolate, acute: fls. few to 15, orange-red, with crimson tips and black spots. Calif,—*L. ochràceum*, Franchet. Chinese, recently discovered, not introduced.—*L. oxypétalum*, Baker. One–1½ ft. tall: lvs. 20–30, scattered, lanceolate-linear: fl. wide funnel-shaped, or nearly rotate, purplish, tinged with green beneath, somewhat dotted inside. Western Himalayas. Not in cult. El. 5.—*L. papillíferum*, Franchet. A recently named species from Yun-nan, China. Not in the trade. Fls. dirty red. Belongs with L. speciosum, etc.—*L. polyphýllum*, D.Don. Three–4 ft. high: lvs. 40–60, scattered: fls. 4–10, in a loose raceme, on nodding pedicels, yellow, with purplish spots. Himalayas. I.H. 32:565.—*L. primulinum*, Baker. A new species from Burma, with pale yellow fls., somewhat resembling L. Nepalense. B.M. 7227.—*L. Púrdyi*, Waugh. Bulb like L. Columbianum: stem 2–5 ft. high: lvs. lanceolate, mostly in whorls: fls. few to 10, horizontal, orange-red, thickly dotted, fragrant. Washington and British Columbia.—*L. Sutchuénse*, Franchet. A new lily of the tenuifolium style, with 1–4 reddish orange flowers spotted with black. Recently discovered in Su-Tchuen, China; not introduced. B.M. 7715.—*L. Taliénse*, Franchet. A recently discovered species of the subgenus Martagon. Fls. white or whitish. China. Not in commerce.—*L. Yunnanénse*, Franchet. A white-fld. species, somewhat resembling L. Japonicum recently discovered in China. Not yet in the trade.

F. A. Waugh.

LILAC. See *Syringa.*

LILY, in the narrowest sense, is restricted to the genus Lilium, but the popular names given below also include plants outside the family Liliaceæ. Many of them belong to the Amaryllis family. **African Blue L.**, *Agapanthus umbellatus.* **African Corn L.**, *Ixia.* **Amazon L.**, *Eucharis Amazonica.* **American Turk's Cap L.**, *Lilium superbum.* **Atamasco L.**, *Zephyranthes Atamasco.* **Bárbadoes L.**, *Hippeastrum equestre.* **Belladonna L.**, *Amaryllis Belladonna.* **Bengal L.**, *Crinum longifolium.* **Bermuda L.**, *Lilium Harrisii.* **Black L.**, *Fritillaria Camtshatcensis.* **Blackberry L.**, *Belemcanda Chinensis.* **Bourbon L.**, *Lilium candidum.* **Brisbane L.**, *Eurycles sylvestris.* **Calla L.**, *Richardia Æthiopica.* **Cape L.**, *Crinum Capense.* **Checkered L.**, *Fritillaria Meleagris.* **Climbing L.**, *Gloriosa* and *Littonia.* **Common White L.**, *Lilium candidum.* **Day L.**, the blue and white ones are *Funkias;* the yellow and orange ones *Hemerocallis.* **Easter L.**, *Lilium Harrisii.* **Fairy L.**, *Zephyranthes rosea.* **Fayal L.**, *Ornithogalum Arabicum.* **Golden-banded L.**, *Lilium auratum.* **Golden-rayed L.**, *Lilium auratum.* **Guernsey L.**, *Nerine Sarniensis.* **Jacobean L.**, *Sprekelia formosissima.* **Kaffir L.**, *Schizostylis coccinea.* **Mariposa L.**, *Calochortus.* **Martagon L.**, *Lilium Martagon.* **Orange L.**, *Lilium croceum.* **Peruvian Swamp L.**, *Zephyranthes candida.* **Plantain L.**, *Funkia.* **Pond L.**, *Nuphar advena.* **Sacred L. of China**, *Narcissus Tazetta*, var. *orientalis.* **Spider L.** **St. Bernard's L.**, *Anthericum Liliago.* **St. Bruno's L.**, *Paradisea Liliastrum.* **St. James' L.**, *Sprekelia formosissima.* **St. Joseph's L.**, *Lilium candidum.* **Tiger L.**, *Lilium tigrinum.* **Turban L.**, *Lilium pomponium.* **Turk's Cap L.**, *Lilium Martagon.* **Water L.**, *Nymphæa.* **White L.**, *Lilium candidum.*

LILY-OF-THE-INCAS. *Alstrœmeria Pelegrina.* See, also, *Hymenocallis* (Ismene).

LILY-OF-THE-PALACE. *Hippeastrum aulicum.*

LILY-OF-THE-VALLEY. *Convallaria majalis.*

LIMATÒDES (probably from the Greek for *meadow*, referring to the habitat of the plants). *Orchidàceæ.* Similar to Calanthe, but the spurred labellum is not adnate to the column but closely wrapped around it. In Phajus, and in Calanthe also, the lvs. are not articulated to the stem and therefore wither on the plant instead of falling.

After resting season of Limatodes is over, say from February to May, shake off the old potting material. If plants are large, divide them and pot them moderately tight. For the American climate, chop finely some good, turfy loam well mixed with old rotten cow manure and a little leaf mold and sharp sand and place in a shaded house, temperature 70° to 90°. Do not water till roots are well out, and sparingly till leaves are well started. After that and during flower-sheath growth, they will enjoy profuse waterings and spraying—water with weak liquid at intervals of 10 days or so, and every plant will be a marvel of beauty.

ròsea, Lindl. (*Calánthe ròsea*, Benth.). Pseudobulbs 4–8 in. long, pyriform or fusiform, grooved: lvs. 8–18 in. long, elliptic-lanceolate, acuminate, plicate: scape from the base of the pseudobulb, 12–18 in. long, slender, bearing a many-fld. villous raceme: fls. large, rosy, 1½ in. across; sepals ovate-lanceolate; petals oblong, acute; lip 1½ in. long, with a large obovate-oblong midlobe; base yellow, edged with scarlet. Jan. Burma. B.M. 5312. —A hybrid of this species and *Calanthe vestita*, Lindl., is common in cultivation under the name *Calanthe Veitchii*, Lindl., which see. John Saul said *L. rosea* bore fls. as large as those of *Calanthe Veitchii*, and more brilliant in color.

Heinrich Hasselbring and Wm. Mathews.

LIME. The use of Lime in agriculture antedates the Christian era. In modern times it has been an indispensable adjunct to potassic, phosphatic and nitrogenous manures in restoring and maintaining the fertility of immense areas of soil derived from sandstone, granite, mica schist and certain shales and slate. Without its use the wonderful transformation of Limousin in France, the sandy regions of Germany, and particularly the reclamation of the sour peat (Hoch-moor) soils of northern Germany would have been difficult or impossible. Even limestone soils sometimes become so lacking in Lime near the surface that they stand in great need of its application.

The necessity of Lime as a direct food for the higher orders of plants has been indisputably demonstrated. Its physiological role is of the greatest significance. It serves also as an indirect food by transforming or setting free other soil ingredients which plants require. (1) It aids in transforming the nitrogen of organic matter and ammonium salts into nitric acid, which, in combination with potash, soda, Lime and magnesia, furnishes most plants the major portion of their nitrogen. (2) It appears probable that liming favors symbiosis and the consequent assimilation of atmospheric nitrogen in the case of clovers, alfalfa and certain other legumes, while it may have an opposite effect upon others, among which may be mentioned serradella and lupines. (3) Lime attacks certain more or less inert combinations of potash and of phosphoric acid which exist in soils, thereby rendering their manurial constituents more readily assimilable.

Noxious iron compounds in soils are so acted upon by Lime as to overcome their poisonous tendency. The presence of carbonate of lime in soils prevents the formation of sour humus and consequent injury to a large class of agricultural plants. Liming makes clays more friable and sandy soils more compact, thus improving the texture of each. By the flocculation of the fine particles of the former, water drains off more readily, and the danger of serious washing is thus diminished. Soluble phosphates are less liable to be lost or changed into unassimilable forms in soils containing Lime. Large quantities of Lime should not be employed upon sandy soils in a single application. The repeated use of highly magnesian Lime is fraught with danger, though, applied occasionally in the place of ordinary Lime, it may prove beneficial. The use of Lime, whether in wood ashes or from other sources, increases the tendency to alkalinity of the soil, and hence makes it more favorable to the development of potato scab, provided the fungus which causes the disease is already in the soil, or is introduced into it upon the "seed" tubers. The disease which develops upon turnips and certain other plants, known as "club foot" or "club root," is lessened to a marked degree by the use of Lime upon the soil.

Lime is usually applied to land at rates ranging from half a ton to two and one-half tons per acre, and at intervals of from four to six years. It should be thoroughly worked into the surface soil after plowing. Upon sandy soils it is applied with the greatest safety after composting with organic matter.

The value of Lime in preparing composts has long been known. Mixed in layers with loam, weeds, muck, coarse stable manure and other vegetable or animal matter, it forms in a few months, if kept moist, an excellent material for the use of gardeners. If worked over a few times at intervals, the operation is materially hastened. The introduction of a little common salt or of muriate of potash facilitates the process by virtue of the formation of carbonates of soda or of potash. In order to prevent loss of ammonia, compost heaps are usually kept covered with moist earth with which gypsum or land plaster may often be advantageously mixed.

The influence of Lime on plant-growth is often astounding. Lettuce, spinach, beets, onions, muskmelons, asparagus, clovers, timothy, Kentucky blue grass and poppies are almost failures upon very acid soil until liming is practiced. Watermelons, lupines, serradella, cranberries, rhododendrons, azaleas, the Norway spruce and other plants might be cited that are known to be injured or ruined by considerable applications of Lime. Their natural home is upon a sour soil. The Early Richmond cherry, though helped somewhat by liming, succeeds upon very acid soil, while the Black Tartarian fails under similar circumstances. The Delaware grape is more in need of Lime than the Concord. Blackcap raspberries do not seem to be helped by liming, even upon very acid soil, though the Cuthbert, a red raspberry, responds to the treatment in a marked manner. The quince is more in need of Lime upon acid soils than the pear, apple or peach. The American linden and American elm are thankful for Lime upon acid soils, while the white birch shows utter indifference to it. The success of the beech upon the limestone soils of Europe indicates its natural home. Chestnut trees are said not to thrive well on limestone soils. Gooseberries and currants are moderately helped by liming on very acid soils. Strawberries exhibit this characteristic only in a slight degree.

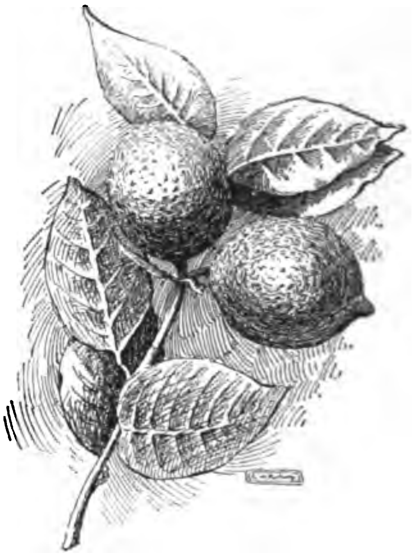
Rhode Island owes its reputation as the home of Rhode Island bent to the fact that this grass can persist upon soil where many other grasses fail, and hence it has won in the struggle for existence. Had the soil been well supplied with Lime it is not probable that such would have been the case. Upon very acid soils, there is little fear that the poppy would ever become a pernicious weed, as is the case in many of the wheat fields of Europe. Such soils are, however, the natural home of common sorrel. The conditions favorable to the poppy are also favorable to wheat. Barley fails upon very sour soils. Oats succeed except upon extremely acid soil, though even soils of that character produce good crops of rye and Indian corn.

He who will use Lime intelligently must study carefully the peculiarities of his soil, and of the plants that are to be grown. H. J. WHEELER.

LIME (FRUIT) of literature is mostly *Citrus Limetta* of Risso, or Sweet Lime, which is now regarded as a form of *C. Medica*. The Sour or West Indian Lime (discussed below) is a much sourer fruit and is *Citrus Medica*, var. *acida* (see p. 325, Vol. 1), Fig. 1293.

The Sour Lime is a useful member of the orange tribe, valuable for its acid fruits, which are prized above lemons in tropical countries for making cooling drinks and for cookery. Limes are also largely used in the manufacture of citric acid. The tree is low, much branched and very thorny, thriving on poorer, rockier soil, and in closer proximity to salt water than other members of the citrous tribe. In orchard planting the trees are set about 15x25 feet apart, and cultivation given them the same as for lemon and orange trees.

The variety most commonly grown is a small-fruited, very prolific sort, ordinarily grown from seed and called "West Indian." The fruits of this sort are shipped from lower Florida and the West Indies to Atlantic coast cities in quantity during summer and autumn. There are several good varieties beside the common "West Indian," all of which are propagated by budding or grafting on strong stocks of various kinds, but especially upon rough lemon and sour orange. Among the best known and valuable may be named Tahiti, which has large, smooth fruits almost the size of lemons and Sour Rangpur, the "Mandarin Lime," in shape and character of fruit much like the China Mandarin, but with intensely acid juice. There are a number of sorts from India being experimented with in Florida, but which are not as yet well tested. The Lime, in almost all varieties, is more tender as regards cold than even the lemon, not being able to withstand sharp frosts without damage. The Sour Rangpur (from India) is an exception, and has proved to be almost as hardy as the sweet orange tree, and has fruited freely in the upper orange belt of Florida. Doubtless by budding or grafting Limes on the *Citrus trifoliata* as a stock, the trees will be able to stand more severe frosts than when worked on more tender roots. E. N. REASONER.



1293. Sour Lime—Citrus Medica, var. acida (X ⅓).

The Lime is but little grown in California. In early days it was freely planted, largely in hedge form around orange groves. Its susceptibility to injuries from low temperatures, which did not harm the orange and lemon, caused its abandonment in our chief citrous fruit regions, and no effort was made to restore the acreage in frostless localities, because the supply from Mexican regions keeps local prices so low as to offer no profit to California growers. At present the Lime has no commercial standing as a California fruit, though several varieties are grown in a few places for home use.

E. J. WICKSON.

LIMNÁNTHEMUM (Greek, *marsh flower*). Including *Villársia*. *Gentianàceæ*. Floating Heart. About 20 species of aquatic plants, widely scattered in tropical and temperate regions. They have 5-petaled white or yellow fls., borne in spring and summer. Floating or creeping: lvs. ovate or orbiculate, heart-shaped at the base, rarely peltate, with a closed sinus, entire or slightly wavy: peduncles with 1, 2 or many fls.: corolla wheel-shaped, deeply 5-cut; lobes fringed or not; stamens 5, fixed at the base of the corolla. Distinguished from Menyanthes by having the capsule 4-valved instead of irregularly 2-valved. Four hardy kinds are procurable from dealers in aquatics and native plants.

Limnanthemums are most useful ornamental aquatic plants, and are represented in cultivation by but four species. *L. lacunosum*—Floating Heart—is the hardiest of American species; its mottled, variegated leaves, about 2 in. broad, are very attractive, regardless of its dainty, white, miniature flowers. It is best grown under natural conditions, in pools and still water, and in water about 2 ft. deep. It may also be grown in tubs, as a surface covering, with a few tall plants in the center. *L. trachyspermum*, commonly known as the Fairy Water-Lily, is a much stronger grower; lvs. deep green, and, when grown in natural ponds, attain large proportions, 4–6 in. broad, and bears innumerable flowers, more like flakes of snow. It is also valuable for tub culture, similar to the preceding variety. *L. Indicum*, commonly called Water Snowflake, is undoubtedly the most interesting and attractive of any, and deserving of most general cultivation. The leaves are of a light green color, heart-shaped, and it produces flowers in greater abundance, which are much larger and covered completely with hirsute glands. These, like the other varieties, are produced in clusters on the petioles, near the surface, and, although they are of but one day's duration, they are produced in such quantities that there is never any lack of these delicate flowers all through the season. In tub culture, this variety (or species) will soon crowd itself over the edge of an ordinary tub, and, although the leaves no longer float on the surface, it does not affect the growth or the proliferousness of its flowering. When grown in tubs, the latter should be filled two-thirds with moderately rich, loamy soil, covered with sand, and filled and kept filled with water. All three species, when strong enough to produce flowering leaves or petioles, produce new shoots, as each cluster of flowers apparently terminates with a bud and produces leaves; these, when strong, produce flower buds and leaf buds again, and thus soon reproduce themselves. *L. trachyspermum* produces a cluster of fleshy roots, with a bud from single leaves in fall, which are plentiful in Florida in the season. These are excellent for distribution, and can be sent safely a great distance. The petioles are very brittle and easily snap off, but the floating leaf soon emits roots at the broken end as well as where the flower buds are located; thus it is very free and proliferous. These are very desirable aquatic plants.

The fourth species, *L.* (or *Villarsia*) *nymphoides*, is a rampant, weedy plant, although its mottled foliage is beautiful and the flower is much larger than those of the above plants. Its habit of growth is also different: it produces runners, and rambles over an immense space; it also produces seed in great quantity, which, when ripe, floats on the surface for a short time, then sinks to the bottom; it is best confined to the limits of a tub, where it grows freely and produces its large yellow flowers in profusion. It is hard to eradicate when once established, as it is perfectly hardy.

A. *Color of fls. yellow.*

B. *Fls. accompanied by clusters of tubers.*

lacunósum, Griseb. Stems sometimes 10 ft. long: lvs. purplish beneath, 1–2 in. long: fls. 3–6 lines across; segments ovate, acute: seeds smooth. July, Aug. Ponds, Nova Scotia to Fla. and La., west to Minn. B.B. 2:622.

BB. *Fls. not accompanied by clusters of tubers.*

nymphoides, Hoffmg. and Link. (Also written *L. nymphæoides*.) Lvs. 2–4 in. broad: fls. 1 in. across or more; segments obcordate, short-fringed. May–July. Eu., Asia; naturalized in District of Columbia. B.B. 2:623. Gn. 24, p. 535.—Simulates *Limnocharis Humboldtii* in habit.

AA. *Color of fls. white.*

B. *Seeds rough.*

trachyspérmum, Gray. Stouter and larger than *L. lacunosum*: lvs. cordate orbicular, thick, entire or repand, 2–6 in. long, spongy: tubers thick: fls. 6–10 lines broad. Apr.–July. N. J. to Fla. and Tex. B.B. 2:623.—"Fairy Water Lily" is a nursery catalogue name.

BB. *Seeds smooth.*

Índicum, Thw. Water Snowflake. Fls. white, yellow towards the base within; segments fimbriated, densely papillose, without a longitudinal fold down the middle. Tropics. Not B.M. 658, which is a yellow-fld. species.

Wm. Tricker and W. M.

LIMNÁNTHES (Greek, *marsh flower*). *Geraniàceæ*. Two or 3 species of American annuals growing near the water. Low, diffuse, rather fleshy: lvs. pinnate: fls. white, yellow or rosy, solitary on axillary peduncles, 1 in. across: fls. regular, the parts in 5's; sepals valvate in the bud; glands alternating with the petals; stamens 10: carpels distinct, at first fleshy, at length hard and wrinkled, indehiscent, separating from the short axis: ovule solitary.

Doúglasi, R. Br. Lvs. pinnate; lfts. sharply lobed or parted; lobes linear: petals oblong-spatulate, notched at apex, more or less yellow, white toward the tip: fr. smooth or slightly corrugated. Calif. B.M. 3554. B.R. 20:1673.

LIMNÒBIUM (*living in pools*, from the Greek): Including *Triànea*. *Hydrocharidàceæ*. Three or four American aquatic herbs, one of which is in the Amer. trade. Stemless plants, spreading by means of runners, the large leaves floating. Monœcious, the fls. arising from spathes borne on the rootstock, the pistillate single from a spathe and the staminate 2–4 from a spathe, all with 6 white segments or petals, the inner ones being very narrow; stamens in a column, bearing anthers at unequal heights: ovary with several (6–9) locules and as many stigmas, ripening into a many-seeded berry.

Bósci, Rich. (*L. Spóngia*, Steud.). American Frog's-bit (the European Frog's-bit is Hydrocharis). A neat floating plant, with purplish, hanging, hairy roots and long-stemmed, cordate or ovate lvs. 1–2 in. long and purplish beneath. Lake Ontario, south and west. Good for the aquarium.

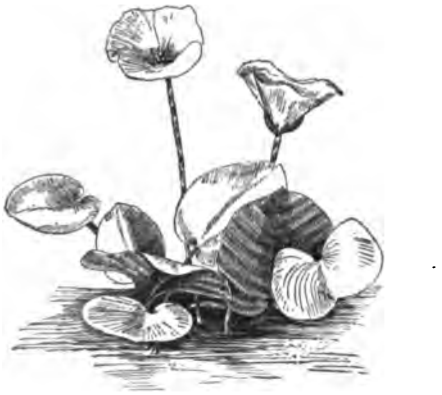
Limnobium Bósci, while it is hardy southward, does not appear to be so in New Jersey. Its mottled foliage and silky rootlets are very attractive and make it valuable in the aquarium, but when grown out-of-doors in summer in tubs or pools, it is very vigorous and soon becomes crowded; the leaves, instead of floating, then appear in an erect state, the spongy condition of floating leaves having disappeared, the plant having no need of such. It is really a floating plant, propagated by division of runners, and should not be placed in shallow water, where it can readily root into the soil.

Trianea Bogotense is mentioned as synonymous with *L. Bosci*, but it is more sturdy in habit, of a lighter color—especially in winter—does not make such long runners, and forms more compact and attractive rosettes of leaves.

Wm. Tricker and L. H. B.

LIMNÓCHARIS (from Greek for *swamp-loving*). *Alismàceæ*. Four species according to the latest monographer (Micheli in DC. Monogr. Phaner. 3) in tropical America. Perennial aquatic herbs, stoloniferous, with ovate, petiolate, floating or emersed lvs., and perfect, with 3 outer and 3 inner parts, fertile stamens about 20, and several or many ovaries. Excellent minor aquatics for greenhouse culture or for planting out in warm summer ponds.

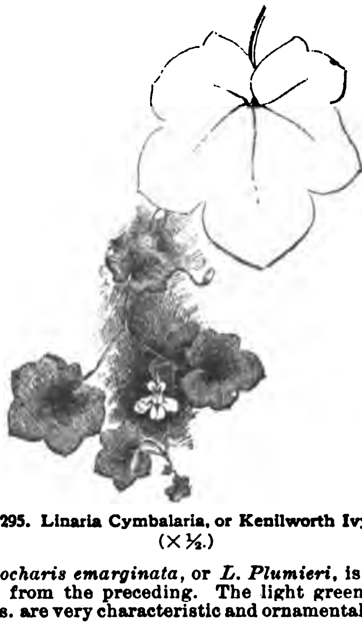
Húmboldtii, Rich. (*L. Cómmersoni*, Spreng. *L. nymphóides*, Micheli. *Hydrócleys Cómmersoni*, Rich.). Water Poppy. Fig. 1294. Stem prostrate and rooting: lvs. broad-cordate-oval, thick, mostly floating: fls. and lvs. arising from bracted nodes, both long-stalked: fls. 2–2½ in. across, with 3 obovate-rounded light yellow petals: carpels 5–7, not united. S. Amer. B.M. 3248. B.R. 19:1640.—A handsome plant with the yellow fls. (lasting 1 day) standing well above the water. In habit, remarkably like *Limnanthemum nymphoides*. Grows well in an aquarium or in shallow water. Continuous bloomer.



1294. Limnocharis Humboldtii (× ¼).

emarginàta, Humb. & Bonpl. (*L. Plumièri*, Rich. *L. flàva*, Buch.). Stouter: lvs. long-cordate-ovate, dock-like, standing out of the water: fls. on long-winged stalks, the yellow petals much contracted below: carpels 15–20, scarcely cohering. S. Amer. B.M. 2525.—Less frequent than the last.

The culture of *Limnocharis Humboldtii* is of the simplest. When grown in tubs, fill the latter two-thirds full of moderately rich soil, covering with sand and fill up with water. Two or three plants planted in the center will, in a short time, furnish the tub with its bright glossy green lvs. and numbers of its bright cheery yellow fls., which continue late in the season. In natural ponds, planted on the edge the plants grow very rapidly, and spread over a large surface of water. In artificial ponds, plant in tubs or boxes and place in shallow water or stand the tub or box on some stand, allowing 6–9 inches depth of water.



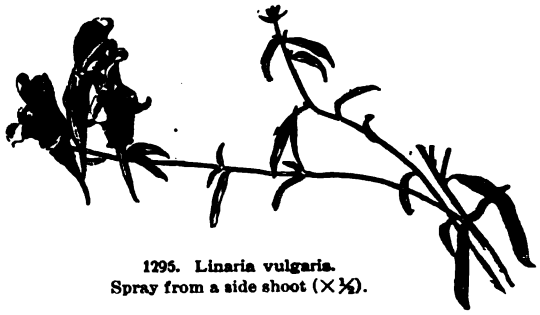
1295. Linaria Cymbalaria, or Kenilworth Ivy. (×½.)

Limnocharis emarginata, or *L. Plumieri*, is entirely distinct from the preceding. The light green oblong, blunt lvs. are very characteristic and ornamental; petiole triangular, 1–2 in. high: the fls., produced on a scape, are pale yellow bordered white. Seed is produced very freely, and as the seed matures the scapes fall to the water, the seed ripens and sinks to the bottom, and where grown out-of-doors, grows freely the following season. The flower-scape, as soon as it rests on the water, throws up a shoot, which produces another plant in a short time, which again produces flowers, seeds and shoots, and so on. The plant may be grown in pots or tubs or planted out in shallow water in early summer.

Wm. Tricker and L. H. B.

LINÀRIA (*Linum*, the flax, which the lvs. of some species resemble). *Scrophulariàceæ*. Low herbs, sometimes subshrubs, of 130–150 species, widely distributed in extra-tropical regions, several species cult. for the oddly-irregular fls. and others for the festooning foliage. Lvs. alternate, or sometimes subverticillate, in the erect-growing species mostly narrow and entire: fls. solitary in the axils, or in terminal racemes, yellow, white, blue or purple; corolla personate or grinning, 2-lipped, usually 1-spurred at the base (in rare or so-called Peloria states 5-spurred); stamens 4, ascending in 2 pairs, slender; style 1: fr. a dry capsule, opening by slits or pores near the summit.

Occasionally the fls. of the common toad flax (*Linaria vulgaris*) are regular. When Linnæus discovered this form, he took the plant to be of another kind and made for it the genus Peloria. This word Peloria is now used generically for the regular state of any normally irregular flower. Such monstrosities occur now and then, particularly in the Scrophulariaceæ.



1295. Linaria vulgaris.
Spray from a side shoot (×½).

In America, Linarias are little known as garden plants, although they are worthy greater attention. They are of two general classes,—the hardy perennials and the annuals. The perennials are prop. by seeds and by division, usually the latter. All the species are of easiest culture in any ordinary soil and exposure, and are largely able to shift for themselves when once established. The annuals may be started indoors; or in warm situations they may be sown where the plants are to stand.

A. *Plant trailing: lvs. palmately veined and lobed (subgenus Cymbalaria).*

Cymbalària, Mill. Kenilworth Ivy. Mother-of-Thousands. Fig. 1295. Perennial tender glabrous herb, but sowing itself freely from seeds, long-trailing and rooting at the joints: lvs. cordate-orbicular or reniform, 5–7-rounded-lobed, on slender stalks longer than the blades: fls. solitary in the axils, on slender stems, small but pretty, lilac-blue with a yellowish throat: capsule globular, splitting from the top. Eu.—It sometimes has white fls. There is also a variegated-lvd. variety. The Kenilworth Ivy is one of the most familiar of trailers on greenhouse bottoms and in odd corners; also as a trailing basket plant in greenhouses and dwelling houses. It is of the easiest culture, particularly in a moist and partially shaded place. Prop. by division of the long stems, or by seeds. It will not stand frost, but the plant will spring up year after year from seed, becoming essentially annual. It has become established in the open in many parts of the East. Continuous bloomer. A good basket plant for poorly lighted places.

AA. *Plant erect or nearly so: lvs. long.*

B. *Flowers yellow.*

vulgàris, Mill. TOAD-FLAX. BUTTER-AND-EGGS. Fig. 1296. Vigorous perennial, spreading freely by underground stems and in time forming large and persistent patches: stems strict, nearly or quite simple, slightly glaucous, 1-3 ft. high: lvs. many, scattered, linear, somewhat narrowed below: fls. in a terminal spicate raceme, erect-spreading, with hanging nectary spur, sulfur-yellow, but orange on the bearded palate. Eu. A.G. 13: 469.—Extensively naturalized, and commonly regarded as a bad weed; but it infests chiefly waste places, and although difficult to eradicate it does not spread very rapidly. Now and then it appears as an ornamental plant. It is more interesting to the general plant-lover than to the gardener. A double-fld. form is figured in G.C. III. 18: 554. The Peloria forms may have 5 spurs, or no spurs at all (R.H. 1851: 433).

Macedónica, Griseb. Robust perennial, 2-3 ft. high, branching: lvs. narrow-ovate or the upper ones lanceolate, somewhat cordate at the base, nearly or quite sessile, entire: fls. bright yellow, with deeper color on the palate, in long wand-like terminal racemes. Macedonia. Gn. 45: 948. J.H. III. 30: 469.—A showy plant, hardy, bearing its snapdragon-like fls. most of the season. Perhaps a wide-leaved form of *L. Dalmatica*, Mill.

BB. *Flowers blue or purple.*

C. *Perennial border plants.*

alpina, Mill. Compact-tufted plants, 6 in. or less high, with weak and spreading flower stems: lvs. linear or lanceolate, mostly in 4's: fls. in short racemes or heads, blue with an orange-colored palate, the straight or slightly curved, sharp spur as long as the corolla. Alps. F.S. 20: 2128. G.C. II. 14: 105.—A pretty little alpine, blooming in July and Aug.

triornithóphora, Willd. Glaucous, 2-3 ft. tall: lvs. ovate-lanceolate, in 3's or 4's: fls. about 3 in a whorl (hence the name, *bearing three birds*), rather large, slender-stalked, violet- and purple-striped, with orange palate, about 1 in. long, the spur inflated above and exceeding the lobes. Spain, Portugal. F.S. 22: 2297.—A handsome and interesting plant, rarely seen in American gardens.

CC. *Annual plants of the flower garden* (See R.H. 1896, pp. 371-374).

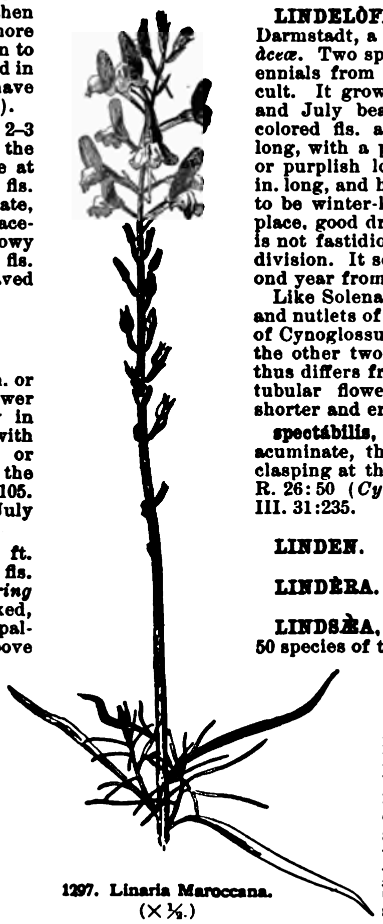
bipartita, Willd. A foot high, erect, branching, with scattered or verticillate linear lvs.: fls. large, in a long racemose spike, violet-purple, with the palate orange-colored above and whitish towards the base, the spur curved, about as long as the corolla, standing oblique or horizontal; upper lip parted. Portugal, N. Afr.—Old-time annual, but it has never been popular in N. Amer. Var. **álba,** Hort., has yellowish white fls. Var. **spléndida,** Hort., has handsome deep purple fls. There is also a var. **striàta,** Hort.

Maroccàna, Hook. f. Fig. 1297. Spike much shorter and denser: fls. bright violet or rose, with a whitish palate, the spur long, pointed, as long as the pedicel and sometimes hanging nearly parallel with the axis of the spike: lvs. many, linear, scattered or whorled, hairy. Morocco. B.M. 5983.

reticulàta, Desf. Fls. pubescent, purple, reticulated with purple, the palate yellow or copper-yellow, the spur pointed and shorter than the corolla and pointing downward: spike short: lvs. linear, scattered or verticillate. Portugal.—An old garden plant, but little known in America. Runs into two or three forms.

L. aparinoìdes, Dietr. See L. heterophylla.—*L. Broussonnétii*, Chav. (L. multipunctata, Hoffmg.). Low annual, with yellow, black-spotted fls., orange on the palate, and lanceolate or linear lvs.: 5-8 in. high, mostly upright. Spain.—*L. Canadénsis*, Dum., is a weedy native plant, of no value to the garden. It is annual or biennial, strict, 1-2 ft., with very small blue fls.—*L. Dalmática*, Mill., is a yellow-fld. perennial: see L. Macedonica, in the main list.—*L. hepaticæfòlia*, Steud. A good alpine, making a very low mat: fls. purple: lvs. cordate or reniform, lobed. Corsica, Sardinia.—*L. heterophýlla*, Desf. (L. aparinoides, Dietr.). Annual, erect, with scattered linear lvs.: fls. straw-colored, with a yellow palate, in spicate racemes. Morocco. B M. 6041.—*L. multipunctàta*, Hoffmg.—L. Broussonnettii.—*L. purpùrea*, Mill. Erect perennial, with long racemes of purple-bearded fls. and linear whorled lvs. Eu. Of little value.—*L. saxátilis*, Hoffmg. & Link. Rockwork perennial, trailing, with thickish lanceolate lvs., and yellow fls. in short clusters Spain.

L. H. B.



1297. Linaria Maroccana. (X ½.)

LINDELÒFIA (Friedrich von Lindelof, of Darmstadt, a patron of botany). *Borraginàceæ.* Two species of hardy herbaceous perennials from the Himalayas, one of which is cult. It grows 1-1½ ft. high, and in June and July bears racemes of drooping, odd-colored fls. about three-fourths of an inch long, with a pale blue tube and 5 deep rose or purplish lobes. The racemes are about 6 in. long, and have 8-12 fls. The plant is likely to be winter-killed unless given a sheltered place, good drainage and winter covering. It is not fastidious as to soil. Easily prop. by division. It seeds freely and flowers the second year from seed.

Like Solenanthus, this genus has the habit and nutlets of Cynoglossum, but the stamens of Cynoglossum are included, while those of the other two genera are exserted. Solenanthus differs from Lindelofia in having a more tubular flower, the lobes being relatively shorter and erect or slightly spreading.

spectábilis, Lehm. Pilose: lvs. oblong-acuminate, the upper ones heart-shaped or clasping at the base: racemes bractless. B. R. 26: 50 (*Cynoglossum longiflorum*). J.H. III. 31: 235.

J. B. KELLER and W. M.

LINDEN. *Tilia.*

LINDÈRA. See *Benjoin.*

LINDSÆA, or Lindsaya, is a genus of about 50 species of tropical ferns, none of which are advertised in America. Schneider, in his Book of Choice Ferns, says they usually die soon after importation, even if apparently in good condition on arrival. In their native habitat, he says, these ferns usually creep about in poor, stony soil, which is frequently drenched and washed away by rain. They need a high temperature and humid atmosphere. Lately some success has been attained by placing Lindsæas in pots nearly filled with crocks, in which they are firmly held by 2 or 3 pieces of turfy loam, and by imitating in other ways the natural conditions described above.

LINNÆA (named after Linnæus, at his own request; it was his favorite flower). *Caprifoliàceæ.* Hardy evergreen trailing subshrub with opposite, small lvs. and light pink, campanulate, nodding fls. in pairs on slender upright stalks. A graceful, dainty plant for rockeries, preferring a shaded position and porous, peaty soil. Prop. usually by division or cuttings of soft or half-ripened wood under glass. Only one species in the colder regions of the northern hemisphere. Calyx 5-parted; corolla campanulate, 5-lobed; stamens 4: ovary 3-celled: fr. dry, indehiscent, 1-seeded. By some botanists Abelia is united with this genus.

boreàlis, Linn. TWIN FLOWER. Fig. 1298. Stems slender, slightly pubescent: lvs. short-petioled, roundish or obovate, with few crenate teeth, ¼-¾ in. long: fls. pedicelled in 2's at the top of slender, upright peduncles; corolla rose-colored or white, about ½ in. long, fragrant. June–Aug. In N. Amer. south to Md., and Calif. in the Mts. B.B. 3:235. Gn. 24, p. 177.

Alfred Rehder.

1298. Linnæa borealis (× ¼).

LINOSPÀDIX (Greek, *linear spadix*). *Palmàceæ*. *L. Petrickiana* is a pinnate-leaved palm from New Guinea, int. 1899 by Sander & Co., who say: "The slender, alternate pinnæ are slightly arched. The base is netted with brown fiber, small, hair-like glumes of the same color being apparent on the younger fronds and leaf-stalks. The young fronds are colored similarly to those of *Areca Ilsemanni*, and when developing have the luster and brilliancy of new copper."

Linospadix contains about 4 species of dwarf, unarmed palms, all from New Guinea, varying considerably in foliage. The genus is allied to Bacularia, but Bacularia has premorse leaf segments and erect anthers fastened at the base, while Linospadix has acuminate leaf segments and versatile anthers fastened on the back. Linospadix is distinguished from Howea (which see) by the stamens 6–9: pistillate fls. with 6–9 staminodes: ovule parietal.

Petrickiàna, Sander. Pinnæ once cut from the apex to a third or fourth the length of the pinna; laterally cut about six-sevenths of the way from the tips of the segments to the rachis: premature basal lvs. cut once from the apex to half their length, the 2 lobes uncut. G.C. III. 24:299.—This is a handsome pinnate-leaved palm of compact growth and well furnished with foliage, at least while in a young state. In its juvenile condition, the leaves of *L. Petrickiana* are simply bifid, the pinnate form gradually appearing as the plant attains age. Cultural conditions suited to the needs of Calamus and Dæmonorops will be most likely to succeed with Linospadix, and include a temperature of 70°, plenty of water, and some shade throughout the year.

W. H. Taplin and W. M.

LINOSÝRIS (*Linum* and *Osyris*, which genera it resembles). *Compósitæ*. One species, *L. vulgàris*, Cass., of Europe, is a good hardy perennial, growing 1½–2 ft. high, and bearing numerous small pale yellow heads: stems strict (from a hard root), striate, finely pubescent, bearing many alternate, small, linear, entire lvs. It is an excellent late summer and fall bloomer, thriving well in any good garden or border. Prop. by division.

The genus Lynosyris is now referred to Aster by many botanists, the above species then becoming *Aster Linosyris*, Bernh. It is also known as *Chrysocoma vulgaris*, Gueld. Horticulturally, it is distinct, with its yellow heads and peculiar habit. From Aster it differs technically in the absence of rays and in yellow fls. L. H. B.

LÌNUM (classical name). *Linàceæ*. Flax. Temperate-region plants of both hemispheres, of 80 or 90 species, herbs or sometimes subshrubs. They are erect-growing plants, with narrow alternate (rarely opposite) and mostly entire lvs., and showy 5-petaled fls. which open in the sunshine. Stamens 5 and alternate with the petals, usually united at the base: ovary 1, 3–5-loculed, bearing as many styles as locules, and ripening into a dry capsule which may or may not be dehiscent. The fls. are borne in terminal racemes or cymes, and, although each flower may be short-lived, the continuity of bloom makes the plant showy. There are two horticultural sections,—the annuals and perennials. All are of easy culture in an open and warm place, fully exposed to the sun. Seeds of the annuals may be sown where the plants are to bloom or they may be started under glass. The perennials often bloom the first year from seed, and seeds are often used to propagate them; but the plants may be divided. There are several native Linums, some of which are small-fld., weedy plants.

A. *Plant annual: fls. red or blue.*

B. *Bloom red.*

grandiflòrum, Desf. Flowering Flax. Figs. 1299, 1300. Erect, branchy, 1–2 ft., glabrous: lvs. many, alternate, broadly lanceolate to oblong, sessile or nearly so: fls. terminating very slender pedicels which are 1–3 in. long, the obovate petals wide-spreading (fl. 1–1½ in. across, and something like a single-fld. pink) and much exceeding the pointed scarious-edged sepals. N. Afr. B.M. 4956. R.H. 1848:401.—Very serviceable garden annual, and popular for its glossy bright fls. The color varies in the shades of red. Var. **rùbrum** has bright red fls. Var. **kermesinum** is crimson. *L. coccineum*, Hort., is a scarlet-fld. form. In a warm, sunny place, the Flowering Flax makes a very satisfactory plant. It is not adapted to cutting, since the fls. are not durable. Will not stand frost.

BB. *Bloom blue.*

usitatissimum, Linn. Flax. Much cult. for linseed and for fiber, and running wild along railroads and in fields: 2–3 ft. high, very slender-branched, glabrous: lvs. small, linear or lanceolate, acute, alternate: fls. about ½ in. across, light blue, soon withering: pod large, mostly exceeding the scarious-edged sepals, nearly or quite indehiscent. L. **hùmile**, Mill., also cult. and sometimes run wild, is lower and has a dehiscent capsule; it is probably only a form of the above.—Flax has been cult. from time immemorial, and it is unknown in an originally wild state. Some authorities consider it to be a modified form of *L. perenne*.

1299. Linum grandiflorum. Natural size.

AA. *Plant perennial: fls. yellow or blue (white vars.).*

B. *Bloom yellow (L. trigynum, which may be sought here, will be found under the genus Reinwardtia).*

flàvum, Linn. Erect from a somewhat woody base, glabrous, 1–2 ft.: lvs. lanceolate or linear, alternate: fls golden yellow, in a much branching cyme, the showy petals much exceeding the glandular-ciliate sepals. Eu. B.M. 312.—A good half-hardy perennial, but not popularly known in this country.

BB. *Bloom blue (or white).*

perénne, Linn. Fig. 1301. Erect-growing and branchy, glabrous, 1–2 ft. tall: lvs. linear and acute, alternate: fls. rather small, azure blue (there is a white-fld. form), on the ends of slender pedicels, the styles and stamens of different lengths (fls. heterogonous) in different fls.: capsules ovoid, dehiscent, on inclined pedicels. Eu.—Worthy hardy perennial, summer-blooming, often flowering the first year from seed.

Lèwisii, Pursh (*L. perénne*, var. *Lèwisii*, Eaton & Wright). The West American representative of the above, and scarcely distinguishable from it except that the fls. are not heterogonous, pedicels more erect in fruit, calyx nerves not evident. Fls. 1½ in. across, clear sky-blue, very pretty. B.R. 14:1163 (as *L. Sibiricum*, var. *Lewisii*).

Austriacum, Linn. (*L. perénne*, var. *Austriacum*, Voss). Lvs. linear, punctate: fls. rather small, violet-red or light blue: fruiting pedicels horizontal or reflexed. Austria.—Hardy North, growing 1–2 ft. high and blooming all summer.

Narbonnénse, Linn. One to 2 ft. high, forming a spreading clump, glabrous and slightly glaucous, and very handsome for rockwork: lvs. linear-lanceolate, pointed, alternate: fls. 1½ in. across, on slender pedicels in loose panicles, azure blue, with white eye and white stamens. Eu. Gn. 52, p. 401.—Blooms in late spring and early summer.

L. H. B.

LION'S EAR. *Leonotis.* **L. Foot.** *Leontice;* also *Prenanthes serpentaria.* **L. Tail.** *Leonotis Leonurus.*

LÌPARIS (Greek, *fat, shining*). *Orchidàceæ.* A large genus, containing over 100 species, distributed over the warm and temperate regions of the entire earth. The plants grow erect, with stems in some species 1 ft. high, bearing 1 or several lvs. and a terminal raceme of small, rarely medium-sized fls. Herbs, terrestrial or epiphytic: stems sometimes thickened at the base into a small pseudobulb, sheathed by scales: lvs. few, broad, contracted into sheathing petioles: fls. whitish, greenish yellow or purplish; sepals and petals nearly equal, linear, spreading; column long; lip nearly plane, often with two tubercles above the base.

L. liliifolia should be planted in well-drained soil; a shady bank is preferable. *L. Lœselii* delights in a wet situation, just at the edge of the water.

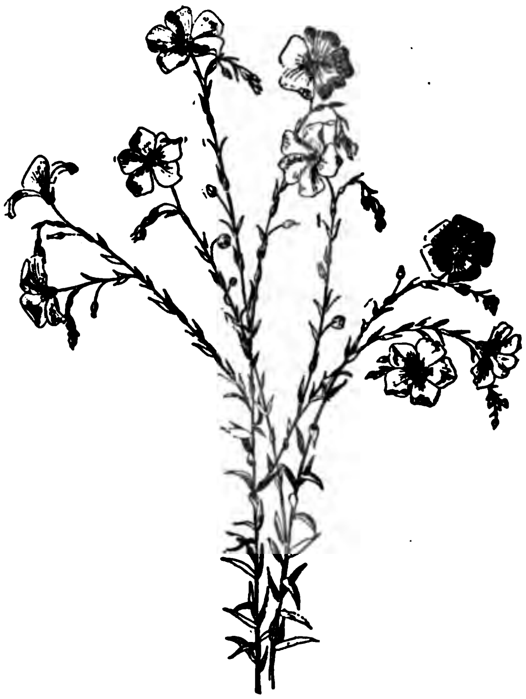
1300. Linum grandiflorum.

liliifòlia, Rich. TWAYBLADE. Plants 4–10 in. high: lvs. oval or ovate, 5 in. long: raceme with many purplish fls.: labellum large, wedge-obovate. Succeeds in well-drained soil on shady banks; woods and thickets, eastern N. Amer. B.B. 1:476. A.G. 12:153 and 13:517.—Procurable from Dutch bulb dealers and dealers in native plants.

Lœsélii, Rich. Plants 2–8 in. high: lvs. elliptic-lanceolate, 2–6 in. long: raceme with few greenish fls.: lip obovate pointed. In wet thickets, N. Amer. and Eu. B. B. 1:477. G.C. II. 21:144.

L. atropurpùrea, Lindl. Plants 1 ft. or more high: lvs. 2–4, nearly round, acuminate plicate, near together at the upper part of the stem: raceme many-fld.: fls. chocolate-purple; lip oblong, obtuse, recurved. June. Ceylon. B.M. 5329.—The most ornamental of the genus.

EDWARD GILLETT and HEINRICH HASSELBRING.



1301. Linum perenne (× ⅓).

LÌPPIA (August Lippi, French traveler, 1678–1704). Syn., *Aloysia.* *Verbenàceæ.* The LEMON VERBENA is an old-fashioned favorite, with delightfully fragrant foliage, a sprig of which was often included in mixed bouquets. It is a low-growing, tender shrub, with long, narrow, pointed, entire lvs., which are usually borne in 3's. In summer, it bears minute fls. in a delicate, pyramidal panicle, composed of many-flowered spikes, which appear in groups of three at decreasing intervals along the main axis. The Lemon Verbena comes from South America, and in the North is deciduous. In northern gardens it needs a winter overcoat of straw. In S. Calif. it attains a large size out-of-doors. Full cultural directions are given at the end of this article.

The genus Lippia is botanically nearer Lantana than Verbena, though the common forms of all three genera are very unlike horticulturally. Some species of Lippia have their spikes crowded into dense heads, like Lantana. The drupe in Lippia is dry, but in Lantana it is often juicy. About 90 species, chiefly American, a few African. Shrubs, subshrubs or rarely herbs, hairy or not: lvs. opposite or in 3's, rarely alternate, entire, toothed or lobed, flat or wrinkled: calyx small, 2–4-cut; corolla with a cylindrical tube, and 4 lobes.

Under the name of *L. repens*, Franceschi introduced into S. California in 1900 an interesting perennial plant designed as a substitute for lawn grass in the South. It makes a remarkably dense mat, and bears numerous tiny flowers an inch or so above the ground. The fls. are borne in a dense, bud-like head, covered with many tightly overlapping bracts. The fls. appear in rings, beginning at the base of the little head. Franceschi writes of this plant that it thrives in any soil no matter how poor, rapidly covers the ground, smothers weeds, stands trampling, requires much less water than grass, needs no mowing, can be easily taken out if desirable, and is used in southern Europe for tennis grounds. Voss pictures this plant with an erect and tufted habit, and refers it, together with *L. canescens*, to *L. nodiflora*. These two names were kept distinct by Schauer in De Candolle's Prodromus, and specimens of Franceschi's plant come nearer to *L. canescens* than to *L. nodiflora*. Schauer's distinctions are given below, but there is doubt as to the chief point of difference; viz., whether any of the plants are annual. They all take root at the joints.

AA. *Plant annual.*

nodiflòra, Rich. Stems herbaceous: calyx 2-parted, slightly 2-keeled, keels puberulous; the whole corolla a little more than one-twelfth of an inch long. Banks and sandy shores in the torrid zone and warmer parts of the temperate zone.

A. *Plant perennial.*

canéscens, Kunth. Stem somewhat woody at the base: calyx 2-toothed, 2-keeled, the keels slightly villous; corolla conspicuously larger than in related species, rosy, with a yellow throat. S. America, in dry, grassy places.

citriodòra, Kunth (*Aloỳsia citriodòra*, Orteg.). LEMON VERBENA. Lvs. in whorls of 3 or 4, lanceolate, short-stalked, glabrous, densely covered beneath with glandular dots: spikes whorled and axillary or collected in terminal panicles, which may be 3 in. long and wide. B. M. 367 (*Verbena triphylla*). Gn. 56:1460. G. C. II. 11:301.

A florist should always have a few Lemon Verbenas. Save a dozen plants in spring, shift them on as required, and in the summer plunge the pots outside. At the approach of frost bring them into the greenhouse, stand them under the lightest and coolest bench, and give them water enough merely to keep the wood from shriveling. In early February shake the plants out of the pots, shorten the unripened and weak wood, repot in fresh soil, using 4-inch pots, and start the plants into fresh growth in a temperature of 55°. In a few weeks they will be covered with new growths suitable for cuttings. Cuttings root readily in about 3 weeks. The sand of the cutting-bench should be a little warmer than the air. Water the sand twice a day, and keep it well soaked. Never allow the cuttings to wilt from sunshine or dryness. Transfer the cuttings when rooted to 2-inch pots, and in April shift to 3-inch pots, plunging them in a mild hotbed, where by the middle of May, with one pinching, they will have become fine, bushy plants. They need frequent syringing to prevent attacks of red spider.

WM. SCOTT and W. M.

LIQUIDÁMBAR (a compound of the Latin *liquidus*, fluid, and the Arabic *ambar*, amber, the name given by the Spaniards in America from the fragrant sap which exudes from the tree). *Hamamelidàceæ*. A genus of about 4 species, the one commonly known being the Sweet Gum or Liquidambar of the middle and southern states, a most interesting tree from its symmetrical head, star-shaped maple-like lustrous lvs., brilliant autumnal color, deep furrowed bark and corky winged branches. Its branches are short in proportion, and slender, giving it, when young, a narrow, pyramidal head, which becomes, when old, a narrow, oblong crown. Its foliage in autumn usually assumes a deep crimson. Its corky branches, not a wholly constant character, add to its picturesqueness and lend to its interest in winter. In the southern states, where it frequents river bottoms and is one of the most common trees, it reaches the height of 80 ft. or more. Farther north, where it is found on the borders of swamps and is rarer, it reaches the maximum of 60–70 ft. On drier and higher ground, it remains a small tree. In cultivation it is of moderate growth, thriving both in low, damp places and on higher grounds, reaching a height of 30–40 ft. Beautiful at every stage, its habit adapts it to both informal and formal planting, in the latter respect particularly to street and park planting, under which conditions it succeeds well. One of the most valuable trees in cultivation in the middle and southern states; its lack of hardiness farther north forbids its use there. It is free from insects and diseases, and is said to withstand salt air. Its resin resembles the liquid storax of the Orient. It is propagated by seeds, which should be stratified as soon as ripe, many of them lying dormant until the second year. It requires close pruning when transplanted.

styraciflua, Linn. SWEET GUM. BILSTED. STAR-LEAVED or RED GUM. ALLIGATOR TREE. A native tree, 80–140 ft. high: lvs. simple, alternate, generally rounded in outline, deeply and palmately 5–7-lobed, serrate, aromatic, deciduous, glabrous below except a pubescence in the axils of the veins; lobes triangular-ovate, acute; petioles 6–7 in. long, slender: fls. apetalous, monœcious, in globular heads, the staminate heads greenish, ½ in. in diameter, in terminal racemes, the pistillate heads solitary, long-peduncled, at length drooping, 1–1½ in. in diameter, hanging all winter: staminate fls. have no calyx, but numerous stamens intermixed with small scales; pistillate fls. cohere as to their ovaries, forming globular heads which harden in the fruit, having scales for sepals, 4 rudimentary anthers and 2-celled ovaries, 1–2-seeded: capsules 2-beaked at the summit, forming together a dense spinose head. March–May. Conn. and southern N. Y. to Fla., Ill., Mo. and Mex. G.F. 2:235. P.G. 3:111. G.C. II. 14:633. Mn. 4:117. Gn. 24, pp. 166, 167 and 38, p. 208.

L. orientàlis, Mill. (L. imberbis, Ait.). A tree of Asia Minor. Very similar to L. styraciflua and differing in that the lvs. are smooth in the axils of the veins.

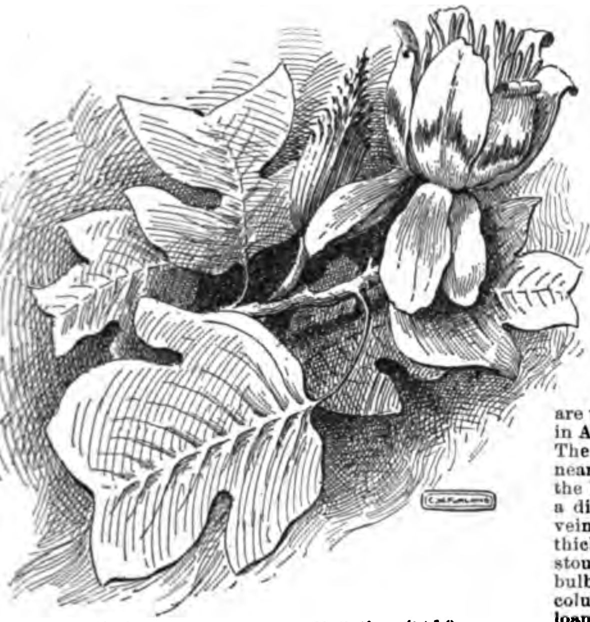
A. PHELPS WYMAN.

LIQUORICE. See *Glycyrrhiza*.

LIRIODÉNDRON (*lirion*, lily, and *dendron*, tree; referring to the shape of the flowers). *Magnoliàceæ*. TULIP TREE. WHITEWOOD. YELLOW POPLAR. Hardy ornamental, deciduous tree of pyramidal habit, with alternate, long-petioled, rather large lvs. of unusual shape, and large tulip-like greenish yellow fls. appearing in spring. A very beautiful tree for park-planting and for avenues, with handsome, clean foliage of rather light bluish green appearance, rarely attacked by insects or fungi, assuming in fall a brilliant yellow color; the fls., though of not very showy color, are conspicuous by their size and shape. The Tulip Tree is also an important forest tree, and the soft, fine-grained, light yellow wood is much used in carpentry for furniture, boat-building and the manufacture of small articles; it does not split easily but is readily worked and bent to any required shape. The inner bark is said to have medical properties. The Tulip Tree grows best in deep, rich and somewhat moist soil. Transplanting is not easy; it is best done in spring, just before the tree starts into new growth. Prop. by seeds sown in fall or stratified and sown in spring; varieties are usually grafted or budded on seedling stock, rarely prop. by layers. The seeds are sometimes hollow, especially those grown along the eastern limit of the species. One species in N. America from R. I. and Vt. to Wis., south to Fla. and Miss.; also occurring in China. Lvs. with conspicuous deciduous stipules cohering when young and inclosing the next leaf: fls. terminal, solitary, with 3 spreading sepals and 6 erect, broadly ovate petals; stamens numerous, with long and linear anthers; pistils numerous, forming a narrow column, developing into a light brown cone, at maturity the carpels, each consisting of a long, narrow wing with a 1–2-seeded nutlet at the base, separate from the slender spindle. The Liriodendron is one of the noblest trees of the American forest.

Tulipífera, Linn. Fig. 1302. Tall tree, to 150, rarely to 190 ft., with a trunk to 10 ft. in diam., often destitute of branches for a considerable height, glabrous: lvs. about as broad as long, with 2 lobes at the truncate and notched apex and 2–4 lobes at the base, bluish green above, pale or glaucous beneath, 5–6 in. long: fls. greenish yellow, marked orange within at the base, 1½–2 in. long. May, June. S.S. 1:13. Em. 2:605. B.M. 275. Gng. 7:259. A.G. 1892:485. Mn. 2, p. 4; 6, p. 145. Gn. 34. p. 42. V. 20:86.—Var. **pyramidàle**, Lav. (var. *fastigiàtum*, Hort.). With upright branches, forming a narrow pyramid. Var. **integrifòlium**, Kirchn. Lvs. rounded at the

base without lobes. Var. **obtusilobum,** Pursh. Lvs. with only one rounded lobe on each side of the base. There are also several vars. with variegated lvs., of which var. **aùreo-marginàtum,** Hort. (var. *panaché*, Hort.), with lvs. edged yellow, is one of the best. F.S. 19:2025; 20:2081.



1302. Tulip tree—Liriodendron Tulipifera (× ½).

—In the middle West, Liriodendron is universally known as Whitewood. To lumbermen in the East it is known as Poplar and Tulip Poplar.

Alfred Rehder.

LIRÌOPE (named after the nymph Liriope). *Hæmadoràceæ.* A tender, bulbous plant from China, growing a foot high, with grass-like foliage and 1 or 2 scapes overtopping the lvs., which bear from July to September as many as 90 violet-colored fls. in a spike-like raceme 6–12 in. long and 1 in. wide. The fls. are less than ½ in. across, 6-parted and arranged in groups of 3–5 along the raceme. They vary from dark purple through violet to whitish. The deepest color is the finest, and is set off by the yellow anthers. The genus has only one species and has been referred to 5 different families. The plant has a short, thick, stoloniferous rhizome, no stem: no perianth tube, and hypogynous stamens. It is procurable through Dutch bulb growers, and should perhaps be grown in the greenhouse the year round.

spicàta, Lour. (*L. graminifòlia*, Baker). Lvs. all radical, linear-lanceolate, obtuse, 3-nerved, with a few brown scales at the base: stamens 6: style columnar: ovary 3-celled. B.M. 5348, B.R. 7:593, and L.B.C. 7:694, all as *Ophiopogon spicatus.*—Var. **densiflòra** (*L. graminifolium densiflorum*, Hort. Van Tubergen) is presumably the best form.

W. M.

LISIÁNTHUS (Greek, *smooth flower*). *Gentianàceæ.* The choice and rare plant known to catalogues as *L. Russellianus* is one of the largest-flowered species of the Gentian family. It is a tender annual from Texas and Mexico, and grows 1½ ft. high, producing its 5-lobed, purple, dark-eyed fls. in summer and fall. Under favorable conditions the fls. are 4 in. across, as many as 10 or 11 on a plant, and individual blossoms have been known to last three weeks. The proper name of this plant is *Eustoma Russelliana.* In Lisianthus, the ovary appears to be 2 celled, because the placentæ are connivent in the middle of the cell, but in Eustoma the placentæ are separated from each other by a considerable space. Lisianthus has about 60 species, all tropical American; Eustoma only 2 species.

Russelliànus, Hook. (Properly *Eustòma Russeliànum*, G. Don). Glaucous: stem simple, or with a few opposite branches: lvs. opposite, connate, ovate or ovate-oblong, 3–5-nerved: fls. panicled, as large as a tulip; lobes obovate, spreading; stigma of 2 very large, green, velvety, spreading plates: pod oblong; seeds minute, pale brown. B.M. 3626. G.C. III. 4:240. R.H. 1863: 51 and 1881, p. 189.

W. M.

This fine plant is difficult to grow in America. In the Old World it is usually treated as a cool greenhouse subject, being sown in early spring for summer and autumn bloom. The writer has not grown it for thirty years, but in view of the renewed interest in this plant, his experience may be useful. The seed should be sown carefully, and at every stage of the plant's growth over-watering should be guarded against. The seedlings are very likely to damp-off. When they are ready for trans-planting from the seed-beds, use small pots. When larger plants are needed, place them in a light, airy place and give generous bottom heat. For soil, use good loam, sand and well-rotted manure.

F. L. Harris.

LISSOCHÌLUS (Greek, *smooth lip*). *Orchidàceæ.* This genus contains about 30 species dispersed in tropical and S. Africa. Some of them are very handsome, but they seem to be little cultivated in America, only a single species being advertised here. The plants are terrestial herbs, distinguished from their near allies by the dissimilarity of the sepals and petals, the latter being much larger and wider and usually of a different color. The lvs. are plicate and prominently veined, long and narrow: stems very short, leafy, finally thickened into pseudobulbs: raceme simple: scape long, stout, sheathed but leafless, growing beside the pseudobulb: labellum spurred or saccate, joined to the base of the column. The plants may be grown in a compost of fibrous loam, leaf-mold and sand. During the growing season they require plenty of water, but during three months of winter they should be allowed to rest and be kept dry.

Krébsii, A. Rich. Lvs. in tufts on the young stems, elliptic-lanceolate, 8–12 in. long: scape 2–3 ft. high: raceme 12–18 in. long, with 20–30 fls.: sepals linear-oblong, bent back, green, with dull purple blotches; petals much larger, golden yellow; lip yellow, pendulous, saccate between the small, rounded lateral lobes; middle lobe orbicular, notched in front. Flowers from May to Oct., the fls. remaining a long time. Natal. B.M. 5861. —Adv. 1895 by Pitcher & Manda.

L. gigantèus, Welw. & Reichb. f. A gigantic orchid whose lvs. are said to grow to a length of 8 ft., with flower spikes twice as high: sepals linear, curled backward; petals oblong-quadrate, 1½ in. across, pinkish rose; labellum 3 in. long, with a long spur; middle lobe trowel-shaped, purple, striped with darker lines. Congo. G.C. III. 3:617. S.H. 2:355. I.H. 35:53.—*L. Hórsfallii*, Batem. A robust plant, with plicate lvs. 2–3 ft. long and 5–6 in. broad, sharp-pointed: flower stalk twice the length of the lvs., with many large fls. 3 in. in diameter: sepals reflexed, rich purple-brown on the upper side: petals much larger, almost square, white, suffused with rose. B.M. 5486. Handsomer than the first.—*L. ròseus*, Lindl. Lvs. broad and stiff: stem 3–4 ft. high: sepals brown; petals and labellum fine rose-colored. B.R. 30:12. Also a showy plant.—*L. speciòsus*, R. Br. Pseudobulbs nearly underground: lvs. dark green, ensiform: scape 2–4 ft. high, with fragrant fls. 2 in. across: sepals small, green, reflexed; petals large, yellow; lip mostly yellow, apparently on the upper side, due to the inversion of the fls. June, July. Cape. B.R. 7:573 (erroneously numbered 578). P.M.B. 4:25.

Heinrich Hasselbring.

LISTÈRA (after Martin Lister, 1638(?)–1712). *Orchidàceæ.* Small, slender, erect herbs, with fibrous or sometimes fleshy roots, bearing a pair of opposite green lvs. near the middle, and 1 or 2 scales near the base of the stem: fls. small, spurless, in a terminal raceme; sepals and petals similar, spreading or reflexed; labellum rather longer, narrow, entire or 2-lobed. About 10 species, natives of the north temperate zone.

convallarioides, Torr. Stem 4–10 in. high, with smooth, round-oval, obtuse, cuspidate lvs.: raceme 2–3 in. long, bearing 3–12 greenish yellow fls. June–Aug. In woods, Nova Scotia to Alaska and Calif.; south to N. C. in the Mts. B.B. 1:473.

cordàta. Very slender, 3–10 in. high: lvs. cordate-ovate, mucronate: raceme 1–2 in. long, with 4–20 minute purplish fls. June–Aug. In moist woods, Nova Scotia to Alaska and Ore., south to N. J.; Eu. B.B. 1: 473.

HEINRICH HASSELBRING.

LITHOSPÉRMUM (Greek, *rock seed;* the seeds like little stones). *Borraginàceæ.* This includes a few low-growing hardy herbaceous perennials of minor importance. The best known is *L. prostratum,* a rock-garden trailer, which bears numerous leafy spikes of blue fls., each about ½ in. across, from early summer to autumn.

1303. Puccoon,—Lithospermum canescens (X ⅜).

1304. Lithospermum angustifolium. Nat. size.

The common Gromwell, *L. officinale,* is rarely cult. as a medicinal herb. The rest are procurable from dealers in native plants. Seeds of the Gromwell and the western species are procurable, and plants of the other kinds. *L. prostratum* is said to be prop. only by cuttings of the previous year's wood; *L. multiflorum* by cuttings of young shoots. The kinds with red roots yield a dye.

Lithospermum has about 40 species in extra-tropical regions: herbs or subshrubs, rough, silky, or bristly: lvs. alternate: fls. white, yellow, bluish or violet; calyx 5-parted; corolla funnel- or salver-shaped, 5-lobed; stamens 5, fixed to the tube: ovary 4-lobed.

A. *Color of fls. blue or purplish.*

B. *Habit trailing: tube of corolla densely hairy, thrice as long as the calyx.*

prostràtum, Lois. GENTIAN BLUE GROMWELL. Subshrub: lvs. lanceolate-linear, margin somewhat revolute: tube of corolla pubescent outside, densely villous at apex. S. Eu. This is presumably the plant in the trade, since *L. prostratum,* Buckl., is a white-fld. annual properly called *L. Matamorense.* However, *L. prostratum,* Lois., is referred by Index Kewensis to *L. fruticosum,* which see. Gn. 45, p. 135. J.H. III. 32:475.

BB. *Habit erect: tube of corolla not hairy.*

fruticòsum, Linn. Distinguished as above by DeCandolle, and apparently more of a shrub, with the leaf margins decidedly revolute. S. Eu.—Not cult.

AA. *Color of fls. pale yellow, yellow or orange.*

B. *Size of fls. small; tube about as long as the calyx: roots not red.*

C. *Inflorescence sparse: throat of corolla crested with appendages.*

officinàle, Linn. GROMWELL. Much branched, 2–3 ft. high: lvs. lanceolate or ovate-lanceolate, 2 in. or less long: fls. dull white. Along N. E. roadsides, but naturalized from Eu.

CC. *Inflorescence dense: throat of corolla nearly devoid of appendages.*

pilòsum, Nutt. Mostly unbranched, 1 ft. high: lvs. linear and linear-lanceolate, 2–4 in. long: fls. dull greenish yellow, crowded in a leafy thyrse. Western N. Amer.

BB. *Size of fls. large, showy: tube of corolla much longer than the calyx: roots red, long and deep.*

C. *Floral leaves reduced to bracts no longer than the calyx.*

multiflòrum, Torr. Height 1–2 ft.: lvs. linear: fls. light yellow, spicate. Rocky Mts. to W. Tex.

CC. *Floral leaves much longer than the calyx.*

D. *Tube of corolla ½–2 times as long as the calyx: crests of throat little if at all projecting or arching.*

E. *Fls. nearly without pedicels: glandular ring at the base naked.*

canéscens, Lehm. PUCCOON, of the Indians. RED ROOT. INDIAN PAINT. Fig. 1303. Height 9–12 in. or more: fls. orange. Plains and open woods, in sandy soil, upper Canada to Ala., west to Ariz. B.M. 4389.

EE. *Fls. mostly pedicelled: glandular ring at base within bearing 10 very hirsute lobes or teeth.*

hírtum, Lehm. Height 1–2 ft.: fls. bright orange. Pine barrens, Mich. to Fla. and Colo.

DD. *Tube of corolla 2–4 times as long as the calyx: crests of the throat conspicuous and arching.*

angustifòlium, Michx. Fig. 1304. Height 9–12 in. or more: lvs. all linear: fls. of 2 sorts, the earlier and conspicuous kind bright yellow, with corolla tube 1 in. or so long, later ones and those of the more diffusely branching plants with inconspicuous pale corolla, without crests in the throat and probably cleistogenous. Apparently all grades between early large fls. and late small ones. Prairies. D. M. Andrews says it has pale cream fls. Var. **longiflòrum** (*L. longiflòrum,* Hort., D. M. Andrews) is said to grow 1 ft. high, with larger, pale lemon fls. and comes true from seed. Grows wild in Colo.

W. M.

LITTÆA. See *Agave.*

LITHRÆA (Chilean name). *Anacardiàceæ.* A genus of small South American trees related to Rhus, and by Bentham and Hooker included in that genus. The plant cult. by some under this name seems not to be true to name, as it is a tree with undivided lvs., while the true plant is as hrub with 1–3 pairs of lfts. and odd pinnate. D. C Mon. Phan. vol. 4.

Aroëirinha, March. (*L. molleoides,* Engl.). Shrub. 9–12 ft. high: lvs. of 5 lanceolate lfts., the rachis and petiole narrow-winged; lfts. 2–3 in. long, glabrous, with small panicles of greenish yellow fls. and almost white drupes 1–2 lines in diam. Brazil.

J. B. S. Norton.

LITTÒNIA (Dr. Samuel Litton, professor of botany in Royal Dublin Society). *Liliàceæ.* Littonia and Gloriosa are called Climbing Lilies. They are tender, tuberous plants, with glossy, lanceolate lvs. which curl at the tips into tendrils, enabling the plants to reach 6–8 ft. The fls. are 6-parted, but in Littonia the segments are not reflexed like a Cyclamen, as in Gloriosa. Fls. nodding, bell-shaped, orange, 1 in. or more across; segments oblong, acuminate, 1¼ in. long: capsule long, 3-celled; seeds scarlet, about the size of a sweet pea, round, arranged in 2 series. The odd-shaped tubers are about 1½ in. across and may be planted outdoors in May. There are 4 species, 1 from Arabia, 1 from S. Africa and 2 from tropical Africa.

modésta, Hook. Lower lvs. in 3's, upper ones alternate: perianth segments provided with a small oblong nectary, partially closed by a ciliated scale on each side: style 3-cut. S. Africa. B.M. 4723. Var. **Keitii,** Hort., is an improved form, with larger and more abundant fls.

John Endicott and W. M.

LIVE-FOREVER. *Sedum Telephium* and other *Sedums.*

LIVERLEAF. *Hepatica.*

LIVERWORT. A general name for a group of cryptogamia (flowerless plants), somewhat allied to mosses and known as Hepaticæ. Conocephalus and Marchantia have been offered by dealers in native plants as suitable for rockwork and bog gardens. Lunularia is a common weed in greenhouses.

LIVING ROCK. Consult *Anhalonium.*

LIVISTÒNA (Patrick Murray, Baron of Livistone). *Palmàceæ.* About 14 species of fan palms from tropical eastern Asia, Malaya and Australia. Trunks usually tall, stout, ringed below, clothed above with dead leaf-sheaths: lvs. spreading, orbicular, plicate, split to the middle or below; the segments bifid, infolded, naked or fibrous along the margins; rachis short; ligule small, cordate, free; petiole long, stout, flat or rounded above, convex below, often spiny along the margins; sheaths margined with reticulate fibers: spadices long, at first ascending, pendent in fruit, long-peduncled, loosely branched, the branches slender: spathes many, long, tubular, compressed, sheathing the peduncle, thick, coriaceous, bifid or 2-lipped, 2-keeled or ancipital: no bracts or bractlets: fls. greenish: fr. smooth and shining, oblong-globose or ellipsoidal, black, blue, yellow or brown.

From the seven allied genera mentioned under Licuala, Livistona is distinguished by the following characters: fls. hermaphrodite: carpels of the ovary globose, distinct or slightly cohering: styles short, distinct or cohering: albumen not twisted, broadly scooped out on the ventral side: branches of the spadices not bracted or the lower ones bracted.

A. *Lvs. glaucous beneath.*

Jenkinsiàna, Griff. Lvs. 5–6 ft. broad, reniform, flabellate, 70–80-fid, glaucous beneath, the divisions very narrow, straight, shortly and obtusely 2 toothed. Assam.

AA. *Lvs. not glaucous beneath.*

B. *Petioles without spines.*

Woodfordii, Ridley. Petioles slender, without thorns, only ¼ in. thick: lvs. orbicular, quite thin, 2 ft. long, 18 in. wide, split into very narrow acuminate lobes, the lower ones free almost to the base, the inner ones split only one-fourth of the way down: spadices very slender, the short slender branches protruding from the mouths of tubular brown sheaths: drupe globose, ⅝ in. in diam., bright red. Polynesia. First described in G.C. III. 23:177.—Nearly related to *L. australis*, but more graceful, with smaller flowers and fruit.

BB. *Petioles spiny below the middle.*

C. *Length of spines ¼in. or less.*

olivæfórmis, Mart. (*Corȳpha Gebánga*, Hort., in part). Stems medium: lvs. glabrous; petiole somewhat 3-angled; spines retrorse, 1–3 lines long; segments 12–15 in. long, deeply bilobed, the lobes very long, acuminate, linear, pendent, with or without very short filaments: fr. olive-shaped, solitary, or twin and connate to the middle. Brazil.

CC. *Length of spines 1 in. or more.*

D. *Shape of lvs. reniform.*

Chinénsis, R. Br. (*Latània Borbónica*, Hort., not Lam.). Stem 6 ft. high, more than 1 ft. thick, gray, with approximate rings: lvs. many; petiole equaling the blade, covered to about the middle with retrorse brown spines, 1 in. or more long; blade reniform, 4–6 ft. in diam.; segments linear-lanceolate, long-pendulous, deeply forked, filiferous, the lower 1–2 ft. long, 1–2 in. wide, the middle 3 ft. long, the lobes acuminate, 4–8 in. long. China.

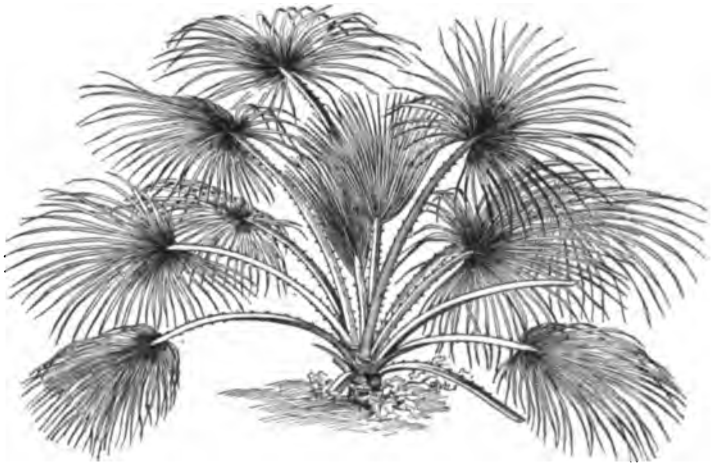
DD. *Shape of lvs. orbicular.*

rotundifòlia, Mart. (*Chamærops Birrò*, Sieb. *C. Byrrhò*, Hort.). Stem 40–50 ft. high, 1–1½ ft. in diam., erect or subflexuous, brownish black, obscurely ringed; petiole 6 ft., with recurved spines 1½ in. long at the base; blade 3–5 ft. in diam., suborbicular, at length somewhat peltate through reversion of the lowest lobes; segments 60–90, connate for one-third their length, bifid to the middle, the lobes long-acuminate. Java. R.B. 21:110. F.R. 1:301. S.H. 2:28.

BBB. *Petioles spiny from base to apex.*

E. *Segments of the lvs. free one-third of the way down.*

altissima, Zoll. Lvs. bright shining green, 1½–2 ft. long; segments free one-third of the way down, bifid at the apex; petiole 2–6 ft., upper part green, brown toward the base, inclosed in a reddish brown network of woody fibers, armed on the margins with stout black recurved spines. Java.



1305. Livistona humilis.

EE. *Segments free nearly to the base.*

F. *Position of segments rigid, not drooping.*

austràlis, Mart. (*Corȳpha austràlis*, R. Br.). Stems 40–80 ft. high: lvs. in a dense crown, orbicular 3–4 ft. in diam., divided to or below the middle into 40–50 narrow, plicate, acuminate segments, either entire or 2-cleft at the apex. Australia. B.M. 6274. Gn. 26, p. 337. V. 9:328

FF. *Position of segments drooping.*

G. *Number of segments 10–12.*

Hoògendorpii, Hort. Stem tall, cylindrical, with triangular leaf-scars: petiole rounded on the back, 3–5 ft. long, red-brown at the base, olive-green above: spines stout, recurved, 1½–2½ in. apart, ¾–2½ in. long: leaf suborbicular, 4½–6 ft. in diam.; segments plicate, cunenate, pendulous at the apex and 5–7-lobed, the lobes acute. Java. I.H. 21:174. F.R. 1:427. Gn. 25, p. 392.

GG. *Number of segments more than 12.*

hùmilis, R.Br. (*L. Mariæ*, F.Muell.). Fig. 1305. Stems 4–16 ft. high: lvs. at length orbicular-cordate, 3 ft. in diam., deeply divided; segments narrow, plicate, acuminate, the filaments between the lobes altogether wanting or very minute or 1 in. long; petiole much flattened, with acute edges bordered with small prickles intermixed with larger ones, often ½in. long. N. Australia. —Fig. 1305 is redrawn from Martius.

subglobòsa, Mart. A medium-sized palm: lvs. glabrous, the rays 10–12 in. long, 2-parted nearly to the base, the lobes linear, very acuminate, pendulous: fr. subglobose. Java.—Known in Java as "Sedangan."

JARED G. SMITH.

This is the most extensively grown genus of fan-leaved palms in commercial horticulture of the present day, its commonest representative being the well-known "Chinese Fan Palm," *L. Chinensis*, which is also known to the trade, and improperly, as *Latania Borbonica*. In general, the members of this genus are by no means difficult to grow, though it is well to make some distinctions in culture between such strong-growing and comparatively hardy palms as *L. Chinensis* and *L. australis*, and the more tender species from Java and northern Australia, among which *L. humilis*, *L. olivæformis* and *L. rotundifolia* are prominent.

For those of the first section a strong loamy soil well enriched with thoroughly decayed stable manure, good drainage, an abundance of water and a night temperature of 60° will provide satisfactory conditions for sturdy growth.

The more tropical species, of which *L. rotundifolia* is a good example, make better progress in a somewhat lighter soil and a higher temperature, 65° to 70° being more congenial to them than the cool treatment accorded their stronger relatives. More shade is also required for the warmhouse species, in order to retain the rich green color that a healthy Livistona should present.

Red spider and white scale are two of the most troublesome insects to the grower of Livistonas, the first being controlled to a great extent by thorough syringing, while the latter may be eradicated by the careful use of various insecticides, though avoiding the frequent application of extract of tobacco, the continued use of the latter substance often resulting in injury to the foliage of Livistonas.

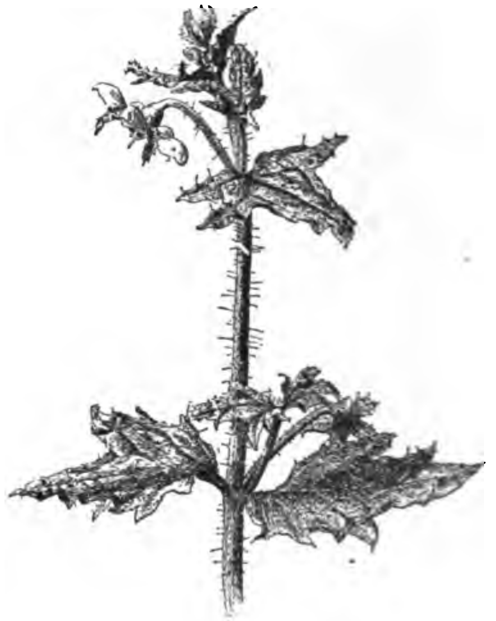
L. australis is a more stubby-growing plant than *L. Chinensis*, the fan-like leaves are stiffer and less graceful, and the footstalks are more thoroughly armed with stout spines, while the leaves are also smaller in proportion to the plant than those of *L. Chinensis*. *L. Hoogendorpii* and *L. olivæformis* are somewhat alike in young plants, but the first has many more and coarser spines on the footstalks, and the stalks of *L. Hoogendorpii* are generally longer, the leaves of both being much divided. *L. rotundifolia* and *L. altissima* are much alike in a small state, and the writer is inclined to think that the seeds of the latter are sometimes substituted for those of *L. rotundifolia*. The leaves of *L. rotundifolia* are flatter and more even in outline, those of *L. altissima* being somewhat undulated, as though they were crowded on the stalk. In fact, small plants of *L. rotundifolia* are usually more symmetrical, and also have longer footstalks.

W. H. TAPLIN.

LLÒYDIA (after Edward Lloyd, who found the plant in Wales). *Liliàceæ*. About 4 species of bulbous plants, of which *L. alpina* was said by Baker to have the widest distribution of any plant in the lily family. Dwarf plants, with hard, grassy lvs. and small, whitish, long-lasting fls.: perianth 6-parted; segments withering and persistent; stamens 6, hypogynous, shorter than the perianth: capsule obovoid; seeds flattish.

alpina, Salisb. (*L. seròtina*, Sweet). Distinguished from the other species by having an oblique, somewhat rhizomatous rootstock and glands on the claws of the perianth segments. Radical lvs. 2–4, linear, convolute: stem usually 1-fld., 3–9 in. long: lvs. 3–4, small, linear: fls. whitish, yellowish purple at its base. Mts. of Wales to Sicily, Himalayas, Colorado.—Adv. 1889 by. F. H. Horsford.

LOÀSA (South American name). *Loasàceæ*. These plants are too much like nettles to deserve cultivation, though their fls. are odd and interesting. The pain from their pricks lasts several days. Each of the 5 hooded petals contains a bunch of stamens. They are treated as half-hardy annuals. (See *Annuals*.) A genus of about 50 tropical American herbs, erect or twining: lvs. alternate or opposite, entire, lobed or decompound: capsule 3–5-valved from the apex, rarely twisted: ovary 1-celled; ovules numerous. The allied genus Blumenbachia differs in having capsules which are longitudinally 5–10-valved and most frequently spirally twisted.



1306. Loasa tricolor (× ⅔).

A. *Sepals as long as petals.*

tricolor, Lindl. Fig. 1306. Annual, 2 ft. high: lvs. opposite, bipinnatifid, very prickly: sepals as long as the petals; petals yellow: crown red: filaments white. Chile. B.R. 8:667.

AA. *Sepals shorter than petals.*

B. *Petals yellow.*

hispida, Linn. Annual, 1½ ft. high: lvs. alternate, 5 in. long, 3½ in. wide, pinnatifid; segments lobed: sepals much shorter than the petals; petals yellow, over 1 in. long. June–Aug. Peru. B.M. 3057. G.C. III. 22:291. Gn. 25, p. 451.—Cult. in pots abroad.

BB. *Petals white.*

vulcánica, André (*L. Wállisii*, Hort.). Erect, bushy annual, 2–3 ft. high: lvs. 3–6 in. broad, 3-parted; segments serrate, each with a long stalklet, the lateral ones often divided into 3 lfts.: sepals shorter than the petals; petals white; eye of fl. of 2 concentric red bands, with 5 yellow spots outside. New Grenada. B.M. 6410. I.H. 25:302. R.H. 1894, p. 233.

BB. *Petals brick-red.*

lateritia, Gill. Without stinging hairs: stem scarcely any: lvs. opposite, long-petioled, pinnatisect; segments rotundate, crenately lobed: peduncles twin, 1-fld., terminal, about as long as the leaf: calyx lobes oval, longer than the corolla tube, half shorter than the corolla. Chile. The above description is from the original one. A much confused plant (see addenda of Ind. Kew under Loasa and Blumenbachia; also equivocal passages in Engler & Prantl Pfl. Fam. 3:6a:118, 119, Lieferung 100). The stinging vine 10–20 ft. high pictured in B.M. 3632 as *L. lateritia*, is a Blumenbachia, of the section Raphisanthe. *L. aurantiaca*, Hort., is usually given as a synonym of *L. lateritia* in botanies, but is kept separate in the trade.

LOBÈLIA (Matthias von Lobel, or L'Obel, 1538–1616, a Flemish botanist and author. Latinized *Lobelius*). *Lobeliàceæ* (by some combined with the *Campanulàceæ*). More than 200 herbs (or sometimes subshrubs in the tropics) of wide distribution in temperate and tropical regions, comprising many species with very showy flowers. Corolla gamopetalous and tubular, split down one side; lobes 5, the 3 on the lower side (as the fl. stands) somewhat united and forming a lip, the other 2 (1 on either side of the cleft or split) erect or turned back; calyx short-tubular or globular, joined to the ovary, short-toothed; stamens 5, united into a tube around the single style, the tube often protruding from the cleft into the corolla: fr. a 2-valved capsule. The flowers are blue, red or yellowish, on 1-fld. pedicels, which are arranged in a terminal raceme. Lvs. alternate, mostly narrow.

There are two horticultural groups of Lobelias,— the annuals and the perennials. The annuals are low, normally blue-fld. species suitable for bedding and edgings. They are of the easiest culture either from seeds or cuttings. See *L. Erinus* (No. 1). The perennials are again of two types,— the hardy and the half-hardy or tender. The hardy kinds are natives, of which *L. cardinalis* and *L. syphilitica* are the leading representatives. These inhabit bogs and low places, and the best results under cult. are to be expected in moist and cool spots. The half-hardy sorts are chiefly derivatives of the Mexican *L. fulgens*, a plant which is deservedly popular in the Old World, but which has not attained great favor here. These species may be bedded out in the northern states. They are carried over winter in pots or in a cellar. They usually give good results the first year from seed, if started early; or seeds may be sown in the fall and the plants carried over in a frame. The hardiness of the hybrid perennial Lobelias in this country is yet to be determined. It is probable that forms of *L. fulgens* will stand outdoors in the middle states if given winter protection. In the latitude of Washington they are hardy in winter but are scarcely able to withstand the summers.

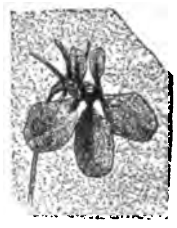
INDEX.

alba, 1 c, 6.
atrosanguinea, 9.
bicolor, 1.
cardinalis, 7.
Cavanillesii, 13.
compacta, 1 a.
erecta, 1 a.
Erinus, 1.
Feuillei, 14.
formosa, 9.
fulgens, 9.
Gerardi, 11.
glandulosa, 6.
Goldelse, 1 b.
Golden Queen, 1 b.
gracilis, 1, 2.
grandiflora, 1 c.
heterophylla, 1, 3, 4.
hybrida, 10.
Kalmii, 5.
Kermesina, 1 c.
laxiflora, 13.
Lindleyana, 1 c.
Lugdunensis, 11.
marmorata, 1 c.
Nanseniana, 9.
Paxtoniana 1 c.
perennis, 10.
pumila, 1 a.
Queen Victoria, 9.
ramosa, 4.
Rivoirei, 12.
speciosa, 1 c.
splendens, 8.
syphilitica, 6.
tenuior, 4.
tricolor, 1 c.
Tupa, 14.

A. *Plant annual (or so treated), low and diffuse-growing.*

B. *Beards or hairy tufts on only the two lower anthers.*

1. **Erinus**, Linn. (*L. heterophýlla*, Hort., sometimes, not Labill. *L. grácilis*, Hort., not Andr. *L. bicolor*, Sims). Figs. 1307–8. Diffuse and half-trailing annual or perennial, much used for edgings. Glabrous or slightly hairy below, 6–12 in. high: lvs. variable, the lower ones obtuse and obovate or spatulate and crenate-toothed, the upper ones oblanceolate or oblong (becoming linear and acute near the top of the stem, and mostly sharp-angle-toothed: fls. ½–¾ in. across, on slender pedicels, light blue with a lighter center; the calyx lobes awl-like, spreading, as long as the corolla tube; 3 lower lobes of corolla large and spreading. S. Afr. B.M. 514, 901.—One of the commonest of all annual edging plants, particularly for early season effects. In our hot climate, it often ceases blooming in midsummer, but with good soil, plenty of water, and occasional cutting back, it will bloom till frost. Seeds sown in January and February will give blooming plants by April and May. For fls. alone, rather than for edgings, the seeds may be started later, or even sown in the open ground. For definite results in edgings, however, it is usually better to start from cuttings. In the fall, lift the best plants and grow them in pots through the winter as stocks from which to secure cuttings. Cuttings taken in late January or February should give blooming plants by May. Seedlings vary, and one cannot rely on them for specific effects in design work, although they may be best for the amateur who desires only fls. Some strains of seeds, however, come very true. *Lobelia Erinus* is also a good pot-plant for the winter conservatory.



1307. Lobelia Erinus. Natural size.

Lobelia Erinus is exceedingly variable. The forms fall into three groups:

(a) *Variation in habit*: Var. **compácta** or **erécta**, dense-growing forms suitable for low, close edgings: subvarieties are blue, white, etc. The most popular bedding forms belong to this strain. The name *erecta* is often used for the taller strains. Var. **grácilis**, with slender growth and suitable for vases or baskets: blue. Var. **pùmila.** Very dwarf.

(b) *Variation in color of foliage:* GOLDEN QUEEN and GOLDELSE, with yellowish foliage. Also forms with bronzy foliage, but not constant.

(c) *Variation in color and size of fls.:* Var. **álba,** white. Var. **flòre plèno,** double. R.H. 1875:71. Var. **grandiflòra.** Various large-fld. forms. Var. **Kermesìna.** Crimson. Var. **Lindleyàna.** Rose-color, with white eye. Var. **marmoràta.** Fls. marbled. Var. **Paxtoniàna.** Light blue with white eye: growth straggling. Var. **Royal Purple.** Purple-blue. Var. **speciòsa.** Large-fld., light azure blue, with white eye. Var. **tricolor.** Fls. blue or pink, with white eye and carmine spots.

BB. *Beards or hairs on all the anthers.* The three following species are probably not in the Amer. trade, although they are known as cult. plants. The names sometimes occur, but the plants which they represent are probably forms of *L. Erinus*. But the descriptions will enable the student to distinguish whether the species occur.

2. **grácilis,** Andr. A foot or less high, slender, decumbent at the base, glabrous: lower lvs. ovate and deeply cut, the upper ones narrower and pinnatifid (becoming linear and entire at the top of the stem): fls. ⅓–¾ in. across, blue with a whitish eye, the middle lower lobe strongly obovate, the 2 upper lobes small and curved and usually hairy: fl.-cluster long and open, more or less 1-sided: seed angled, not winged. Austral. B.M. 741.

1308. Lobelia Erinus.
One of the most popular edging plants.

3. **heterophýlla,** Labill. Much like the last, but fls. larger, (the middle lobe nearly 1 in. long) and the lower leaves parted into linear lobes: seed winged. Austral. B.R. 23:2014. P.M. 9:101.

4. **ténuior,** R. Br. (*L. ramòsa*, Benth.). Erect or ascending, 12–18 in., pubescent: lower lvs. small, mostly ternately divided, the upper lvs. linear and mostly entire: fls. rather large, bright blue, borne far apart on very slender pedicels, the middle lobe much the largest and obovate: seed smooth and shining, compressed. Austral. B.M. 3784 (as *L. heterophylla*). B. 2:93. R.H. 1856:281. G.C. II. 15:105.

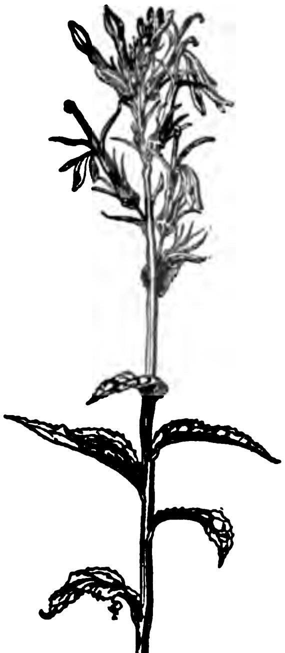
AA. *Plant perennial (rarely biennial), usually tall or strict-growing.*

B. *Corolla very unequally bilabiate or 2-lipped, the lower lip 3-lobed and deflexed, the upper lip very small.*

C. *Species: fls. blue (sometimes varying to white).*

5. **Kálmii,** Linn. A slender perennial (sometimes biennial ?), 6–18 in. high, glabrous, branched: lvs. narrow-spatulate to linear at the top of the stem, remotely denticulate: fls. small (⅓ in. long), very light blue, in a long, loose raceme, on filiform pedicels. On wet banks and slopes and margins of bogs, in N. states: propagating by offsets. B.M. 2238.—Sold by dealers in nativ plants. Useful for bog planting.

6. **syphilítica,** Linn. Strong, weedy herb, 2–3 ft., glabrous or nearly so, mostly simple: lvs. thin, oblong-oval to lanceolate, attenuate to the apex but the point mostly blunt, small-dentate or crenate-denticulate, narrowed into a very short petiole: fls. about 1 in. long in a long, wand-like, racemose spike, blue or purplish, the tube about ⅓ in. long; calyx hairy and enlarging in fruit, the lance-acuminate lobes conspicuous, and bearing auricles in the sinuses. Moist places, E. states. B.R. 7:537; 32:6 (as *L. glandulosa*). Mn. 7:61.—Var. **álba,** Hort., has nearly white fls. Interesting plant for bog gardens and moist borders. In dry soils it will grow, but with less vigor.



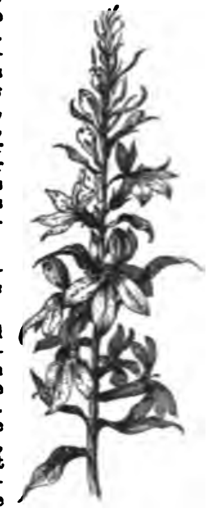
1309. Lobelia cardinalis. (×⅛.)

CC. *Species: flowers in shades of red (or yellow or very rarely white).*

7. **cardinàlis,** Linn. CARDINAL FLOWER. INDIAN PINK. Fig. 1309. Straight-growing, glabrous or very nearly so, 2–4 ft. tall, usually unbranched: lvs. narrow, varying from oblong-ovate to lanceolate, tapering both ways, the petiole very short or none, margin irregularly serrate: fls. bright intense cardinal (rarely varying to white), the tube 1 in. long, the 3 lower lobes very narrow, the fls. borne in a long racemose spike in which the bracts are mostly very narrow and the upper ones little exceeding the pedicels; calyx hemispherical, the tube much shorter than the long-linear lobes: seeds distinctly tuberculate. Wet places, as in swales, eastern N. Amer. B.M. 320. G.W.F. 41.—One of the most showy of all native flowers, and worthy of cult. in any moist border. It has been long in cultivation, but has probably given no important horticultural forms.

8. **spléndens,** Willd. Like *L. cardinalis*, but more slender, the lvs. narrower and glandular denticulate, mostly sessile: seeds little tuberculate. Wet places. Tex., W. and S.—Once adv. by Saul.

9. **fúlgens,** Willd. (*L. formòsa*, Hort. *L. cardinàlis*, Hort., in part). Very like the last, but fls. larger, deeper red and more showy, the 3 lobes of the lower lip broader: plant mostly pubescent (at least the foliage), and variously tinged or spotted with brown or bronze: bracts more leafy. Mex. B.M. 4002 (as *L. splendens*, var. *atrosanguinea*).—Long in cult. and a most desirable plant. Not hardy without protection in the N. It has given rise to many horticultural forms, some of which (as "Queen Victoria") are commonly referred to *L. cardinalis*. The trade name *L. cardinalis atrosanguinea* probably belongs to this species. The recent *L. cardinalis Nanseniana*, a purple-carmine sort, is probably *L. fulgens*. In Europe, this Lobelia is one of the popular bedding plants, but it has never gained popularity in Amer. In this country it is usually grown in pots and treated as a conservatory subject.



1310. Lobelia Rivoirei. (×⅓.)

CCC. *Species-hybrids or derivatives: fls. mostly in shades of red, pink or purple.*

10. **hýbrida,** Hort. The hybrid Lobelias are mostly of French origin, and they are little known in the Amer. trade, although they are occasionally imported by amateurs. It is doubtful if they will endure the winters of the northern states, although they make excellent pot subjects for blooming in the summer border. They may also be planted in the open and lifted on the approach of winter: or new stock can be raised from divisions of the old plants, or from offsets, or from seeds. Many of these hybrids are most showy, and they should be better known in Amer. It is probable that they are derived chiefly from *L. fulgens*, although they are said to come largely from *L. cardinalis*, but *L. fulgens* and *L. cardinalis* are confused amongst gardeners. *L. syphilitica* has also, apparently, entered into some of these hybrid derivatives, particularly those with blue or purple colors. These hybrids are sometimes known collectively as *L. hybrida* and *L. perennis hybrida*. Two recent forms deserve separate mention:

11. **Gerárdi,** Hort. Habit of *L. fulgens* or *L. cardinalis*: lvs. lanceolate or lance-oblong, glabrous, denticulate: fls. in a heavy terminal spike or raceme, rich violet. 1⅓ in. or more long. Obtained by Chabanne and Goujon of the Botanic Garden of Lyons, and introduced to the trade in 1895 by Rivoire Père et Fils, Lyons. The hispid calyx suggests *L. syphilitica*. R.B. 22, p. 112. I.H. 42, p. 268.—It varies into rose-color (var. **Lugdunénsis**) and into coral-red, violet-purple, and the like. The pistillate parent was a form of *L. syphilitica* and the staminate parent was the "Queen Victoria" form of *L. fulgens*. The plant was named for M. Gérard, director of the botanical collection at Lyons.

12. **Rivòirei,** Hort. (Fig. 1310), comprises still more recent types, with very large rose or pink fls. Gn. 56:1238, which plate represents several derivative Lobelias. G.C. III. 24:233.

BB. *Corolla somewhat equally 2-lipped, the lower lip only notched, the upper one 2-parted.*

13. **laxiflòra,** HBK. (*L. Cavanillesii*, Mart. *Syphocámpylus bicolor*, Don). Tall, branching herb or subshrub, with thinly hairy stems: lvs. lanceolate or ovate-lanceolate, acuminate, sharp-denticulate: fls. nodding, on long, axillary pedicels, 1⅓ in. long, cylindrical, the stamens projecting from the side, red and yellow, pubescent. Mex. B.M. 3600. G.C. III. 1:585.—An old plant requiring cool greenhouse culture, or thriving in the open in pots. It may also be planted out like *L. fulgens*.

BBB. *Corolla with all the lobes united by the tips into one lip.*

14. **Tùpa,** Linn. (*Tùpa montàna*, Hort. *L. Feuillei*, Don). Very strong herb or subshrub (4–7 ft. tall), erect and mostly simple: lvs. oblong-oval, mostly acuminate, rugose, tomentose, denticulate: fls. in a long, terminal raceme, blood-red, 2 in. long, the hooded lip curving downwards and the column of stamens ascending; calyx lobes short. Chile. B.M. 2550. R.H. 1898, p. 189.—Cool greenhouse; hardy in southern states with protection.

L. amœna, Michx. Much like L. syphilitica, but the calyx plain and not hispid. N.C., south.—*L. ánceps* Thunb. Perennial, blue-fld., with somewhat fleshy lvs. and 2-winged stem. S. Afr. B.M. 2277, as L. decumbens, and 2519, as L. rhizophyta.—*L. coronopifòlia*, Linn. Somewhat shrubby, with pinnatifid, hairy lvs. and handsome blue fls. (sometimes 1 in. long), on long scapes. S. Afr. B.M. 644. G.C. II. 15:105.—*L. Dortmánna*, Linn. WATER LOBELIA. Aquatic perennial, 1 ft. or less, with lvs. radical and submerged, and small pale blue fls. on a scape. Useful amongst aquatic plants. Native.—*L. horténsis*, DC., is a hybrid form of L. amœna, probably not in cult. now.—*L. infláta*, Linn. INDIAN TOBACCO. Annual, of N. Amer., with ovate, pubescent, denticulate lvs., erect habit, and small blue or whitish fls.: herbage very acrid: plant formerly a domestic remedy.—*L. subnùda*, Benth. Annual from Mex., with radical lyrate lvs. and small pale blue fls. on long pedicels. G.C. III. 2:304.

L. H. B.

LOBLOLLY BAY. *Gordonia Lasianthus.*

LOCHÈRIA (probably a personal name). Comprises a few species, which are now referred to Achimenes. In the trade are 2 species, *L. heterophýlla*, Oerst., or *L. ignéscens*, Klotzsch (see *Achimenes heterophylla*, p. 18), and *L. hirsùta*, Regel (see *Achimenes hirsuta*, DC., p. 18, suppl. list).

LOCO WEED. See *Astragalus.*

LOCUST. Common Locust is *Robinia Pseudacacia*. **Honey** L.=*Gleditschia triacanthos*. **Swamp** or **Water** L.=*G. aquatica*.

LODEMAN, ERNEST GUSTAVUS (Plate X), horticultural investigator and writer, was born in Neufchatel, Switzerland, May 3, 1867, and died Dec. 2, 1896, when connected with Cornell University, Ithaca, N. Y. His parents came to America when he was two years old, his father becoming, in 1870, professor of modern languages in the State Normal School of Michigan. The son entered the Agricultural College of Michigan, where he graduated in 1889. It was in this institution that the writer made his acquaintance. Modest and lacking in self-assertion, he needed encouragement and stimulus to make a strong investigator and teacher. In a real estate venture in Florida, before his entering the Agricultural College, he became interested in agricultural problems and resolved to devote his life to them. In 1890 he undertook work as private assistant to the writer; and from this he became assistant and instructor in Cornell University. In the extension work amongst New York farmers he had charge of the investigations on grapes and strawberries. He was the originator of the spray-calendar idea. In 1896 he published "The Spraying of Plants," which is yet the fullest presentation of the subject. This was prepared after a most thorough traversing of the subject, both as author and experimenter, including a visit to Europe for the purpose of tracing the French history of the subject. He was an accomplished scholar, speaking German and French with fluency and possessing a working knowledge of other languages. His early death deprived American horticulture of a promising leader.

L. H. B.

LODOÍCEA. The double cocoanut or coco de mer, as *L. Sechellarum* (properly *L. Callipýge*, Comm.) has been termed, is one of the giants among palms, its straight and smooth trunk frequently reaching a height of 100 feet, and it is also a centenarian before its full growth is attained. The seeds of Lodoicea are probably the largest known, the individual nuts being said to weigh sometimes 40 pounds, though the largest seen by the writer weighed about 15 lbs., and bore some resemblance to a malformed cocoanut. The formation of such gigantic seeds requires a considerable period of time, and from the time of flowering to the full maturity of the seeds is said to cover a period of nearly ten years. The germination of such seeds is not an easy process, requiring much room and strong heat, the radicle being correspondingly large and running down for 3 ft. or more before the top growth begins. These first steps in the life of Lodoicea develop some very tender processes. Young plants of this palm require a strong and moist heat; and a considerable amount of root room, in combination with a light but rich compost, is best adapted to their needs. Seeds sometimes require 3 years to germinate. They are not advertised for sale at present, but have been sold as curiosities now and then in America. Their germination is a great event, but the plants are never grown to any considerable height, as they require too much care and room. See G.C. II. 26:181; III. 4:732; 8:417. F.S. 5:523.

W. H. TAPLIN.

LŒSÈLIA (John Lœsel, an early Prussian botanist). *Polemoniàceæ.* Very close to Gilia, and often confounded with it. As finally outlined by Gray (Suppl. Syn. Fl.), it is confined to Mexico and includes perhaps a dozen species. It somewhat resembles the Ipomopsis section of Gilia in habit. "Fls. involucrate or involucellate; both bracts and calyx wholly or partly scarious; corolla funnelform, either regular or one or two sinuses deeper; seeds winged or margined, the surface becoming mucilaginous when wetted. Suffruticose, rarely annual, with spinulose-toothed lvs."

L. coccinea, Don, is a handsome coolhouse plant with brilliant rose-red tubular-trumpet-shaped fls. an inch long in terminal fascicles or compound bracted racemes, with stamens and 3-lobed stigma exserted: lvs. small and stiffish, oval or cuneate-oval, sharply and often spinulose dentate, grayish green: plant strict, pubescent, woody, perennial. Winter bloomer. It does not appear in Amer. trade lists. **L. tenuifòlia,** Gray, and **L. effùsa,** Gray, of S. Calif., are phlox-like plants offered by Orcutt, in 1891. The former, Gray subsequently referred to *Gilia tenuifòlia*, Gray, and the latter to *Gilia Dúnnii*, Kellogg.

L. H. B.

LOGANBERRY. The Loganberry is a valuable hybrid produced at Santa Cruz, California, in 1881, by Judge J. H. Logan, from a seed of the Aughinbaugh blackberry, accidentally fertilized from an adjacent raspberry, supposed to be the old Red Antwerp. The Aughinbaugh is a pistillate variety of *Rubus vitifolius*, the extremely variable wild blackberry of California, and was a chance seedling found beneath the oaks of Alameda, about 1860. It is a strong-growing, dark green vine of the dewberry type, but with fruit of the true wild blackberry flavor. The Loganberry fruit has many characteristics of both parents. It is a rich, dark red color when ripe, and sometimes is an inch and a quarter in length. The plant has been widely disseminated throughout the United States and Europe since 1893, when the California Experiment Station, after five years' testing, first distributed stock. G.F. 7:466.

The Loganberry is propagated from stolons developed in the autumn at the end of the canes, or from single-eye hardwood cuttings. Seedlings are especially unreliable. Plants should be trained upon a wall or trellis, keeping the berries from the ground. Two adjacent vines at Berkeley, California, cover 12 square yards and yielded four gallons of fruit in 1899. If careful winter protection is given, the plants can be grown in many parts of New England and the middle states, according to Bulletin 45 of the Rhode Island Experiment Station and Bulletin 147 of the New York (Geneva) Station.

The value of the Loganberry for the home garden wherever it is sufficiently hardy is generally recognized, but its value as a standard market crop has yet to be determined. It proves difficult to transport to the Los Angeles and San Francisco markets except when grown within a short distance, and dealers prefer the standard berries. When it can be gathered near the time of greatest perfection and delivered directly to the consumer, it becomes a very popular fruit.

CHAS. H. SHINN.

The Loganberry in the East.—In the East the Loganberry has not met the expectations at first entertained for it. It is reported tender in nearly all localities, requiring the best of winter protection, and even then often being injured. Thorough covering with earth in late autumn is the most satisfactory method of doing this and is absolutely essential. The berries are large, but the plants, at best, are only moderately productive. In quality the fruit ranks low, though apparently improved by cooking. Few persons like the flavor of the fresh fruit. It now seems unlikely that the Loganberry will ever become prominent in the East. FRED W. CARD.

LOISELEÚRIA (after J. C. A. Loiseleur-Deslongchamps, physician and botanist in Paris, 1744–1849). Syn., *Chamælèdon*, *Chamæcistus*. *Ericàceæ*. Procumbent hardy evergreen shrub with very small, mostly opposite, closely set, entire lvs., and with small, usually rose-colored fls. in terminal, few-fld. umbels. Well adapted for rockeries, forming depressed tufts, but not easy to grow and rarely cult. It grows best in a sunny or partly shaded position in a porous, peaty and sandy soil, which is well drained and has a constant but moderate supply of moisture. Prop. by seeds treated like those of Azalea or by cuttings of half-ripened wood under glass. Only one species in the subarctic regions and high mts. of the northern hemisphere, formerly included under Azalea, but more closely allied to Kalmia: corolla broadly campanulate, 5-cleft; stamens 5: capsule 2–3-celled.

procúmbens, Desv. (*Azàlea procúmbens*, Linn.). Only a few inches high, quite glabrous: lvs. petioled, oval to narrow oblong, revolute at the margin, about ¼ in. long: fls. 1–5 on rather short pedicels, pink or whitish, about one-fifth in. across. July, Aug. L.B.C. 8:762.

ALFRED REHDER.

LÒLIUM (the ancient Latin name). *Gramíneæ*. DARNEL. RYE-GRASS. Includes about 6 species of the Old World grasses, 2 of which are introduced in the eastern states and 2 are familiar fodder grasses of the same region. Perennial Rye-grass was probably the first pasture grass to be cultivated in Great Britain, and is grown there yet to a considerable extent, where it is said to occupy the same relative position of importance that Timothy does here. A weedy species, *L. temulentum*, is supposed to be the "tares" of Scripture. It is the Darnel, although that name is sometimes, but perhaps erroneously, applied to other species. Spikelets several-fld., sessile, and placed edgewise on opposite sides of a zigzag axis, forming a narrow spike. Our 2 cult. species are short-lived perennials or the second scarcely more than an annual, not to be recommended for permanent pasture or lawn, but are frequently employed for hay or annual pasture. They are successful only in the moist regions of the eastern states. Seed sown in autumn or early spring, 25 to 30 pounds to the acre.

perénne, Linn. PERENNIAL RYE-GRASS. One to 3 ft. high, with flat, shining lvs. and a slender spike, 4–10 in. long: spikelets 8–16-fld., awnless or only short awned.

Itálicum, A. Br. ITALIAN RYE-GRASS. Considered by many as a variety of the preceding. Differs chiefly in having longer awns to the florets. A. S. HITCHCOCK.

LOMÀRIA (Greek, *Loma;* a forage). *Polypodiàceæ*. A genus of rather coarse ferns occasionally with a short caudex, allied to Blechnum. Sori arranged in lines, parallel with the midrib, and occupying nearly the entire space between the midrib and the margin of the leaf. Lvs. of 2 sorts. Some 35 species are known, largely from the southern hemisphere. L. M. UNDERWOOD.

Lomaria gibba is one of the most distinct and symmetrical ferns in cultivation. It includes several valuable varieties. The terminal cycas-like crowns are most beautiful and graceful. In their young state Lomarias make good plants for table decorations, principally as center pieces, but after they begin to form a stem or trunk-like base, they make fine decorative house specimens. Var. *intermedia* is somewhat coarser than *L. gibba* and of more erect habit. Var. *crispa* differs only in the pinnæ being more or less crested and wrinkled. It does not grow quite as fast or as strong as either *L. gibba* or var. *intermedia*. There are several other varieties of less commercial value.

Propagation is entirely from spores, which are produced freely on the second or third course of fronds. These spores must be treated much like other fern spores. They should be sown or laid upon very fine peaty soil or fine leaf-mold with a good portion of very fine silver sand, in shallow pans, boxes or flats, and kept in a warm and close atmosphere, well shaded from the sun. A temperature of 75° to 80° is best suited to them. The pans or boxes should be covered with a pane of glass, and this must be removed at intervals in order to keep the germinating spores from damping-off. After the young plants are large enough to be handled with the assistance of a small stick, they may be pricked off and transferred into fresh soil of the same quality, with perhaps a little loam mixed in and again placed in a congenial, warm, moist place in the propagating- or warmhouse, and again covered with glass. Give air and ventilation to keep them from being attacked by fungus. After producing the first two upright fronds, they may be put into thumb-pots. The soil now should be one-half loam and one-half peaty or leaf-mold soil, with plenty of sharp sand. Ample drainage must be afforded, and the plants kept in a temperature of not less than 60° to 65°.

The Lomarias, above all other ferns, must never be allowed to get thoroughly dry. They love abundance of water. Under proper treatment, they will soon make fine specimens. When the plants are of good size, they may be grown into miniature tree ferns, and as they make quantities of roots and soon get pot-bound, they can be reduced and root-pruned and put back into smaller pots. With gentle bottom heat, they soon make a new set of roots and new crowns or tops. When thoroughly established in this shape, they make fine decorative plants. Lomarias should never be exposed to the full sun. HENRY A. SIEBRECHT.

A. *Plant with a distinct caudex or trunk.*

B. *Lvs. 6–12 in. long.*

ciliàta, Moore. Caudex 6 in. high, 1½ in. thick: stipes blackish: lvs. 8–12 in. long, the upper pinnæ with a rounded auricle at the lower side of the base; fertile lvs. narrow-linear. New Caledonia.

lanceolàta, Spreng. Caudex elongate, densely clothed with dark brown scales: lvs. 6–12 in. long, 2–4 in. wide, with close, slightly falcate pinnæ; texture leathery; fertile pinnæ linear spreading. Australia and Polynesia.

BB. *Lvs. 1½–3 ft. long.*

C. *Lower pinnæ connected at base.*

discolor, Willd. Caudex ascending: stipes black, glossy, with dense scales at base: lvs. 1½–3 ft. long, 4–6 in. wide, with pinnæ narrowed suddenly toward the point; fertile pinnæ narrower and shorter. Australia and New Zealand.

gibba, Labill. Caudex 2–3 ft. high: stipes short, with black scales: lvs. 2–3 ft. long, 6 in. wide; fertile pinnæ narrower, 4–6 in. long.—Var. **platýptera**, is advertised. *L. intermèdia*, Hort., may be derived from this species. New Caledonia.

CC. *Lower pinnæ narrowed at base and distinct.*

Boryàna, Willd. Caudex stout, erect, 1–3 ft. high, woody, densely scaly: lvs. 1½–2 ft. long, 6–8 in. wide, narrowed and sometimes auricled at base; fertile pinnæ narrow-linear, close. West Indies to Patagonia, Mauritius and S. Africa.—Probably includes 2 or 3 species, among them *L. zamiæfolia*, Hort.

AA. *Plant with a stout, short, creeping rhizome.*

Spicant, Desv. Sterile lvs. lanceolate, 6–9 in. long, 1–1½ in. wide, gradually narrowed below; fertile lvs. 1 ft. long, with longer stalks (6–9 in.) and narrowly linear pinnæ. Eu., western N. Amer.—The large Californian form with lvs. 2–3 ft. long is possibly a distinct species. The European plant was early called *Struthiopteris spicant* by Scopoli, by which name it is now cited as the earliest generic name. Hardy; needs deepest shade.

Nippónica, Kunze. Lvs. 15–20 in. long, abruptly pointed at the apex, the lower divisions gradually reduced and strikingly surcurrent; texture thick; fertile lvs. with pinnæ ½ in. apart, narrow-linear, scarcely forming a wing to the rachis: indusia forming pod like structures, tough, persistent. Sometimes referred to the last species. Japan. L. M. UNDERWOOD.

LOMARIÓPSIS. Consult *Acrostichum sarbifolium.*

LOMATOPHÝLLUM is a genus of the lily family with 3–5 species in the Mascarene Islands. They have the habit and perianth of Aloe, but differ in the red-margined leaves and fr. a berry. They are fleshy sub-shrubs with hermaphrodite fls. and introrse anthers as in Sanseviera, but differ in having declined hypogynous stamens and several ovules in a cell, whereas Sanseviera has erect stamens inserted on the throat of the tube and solitary ovules. Not cult.

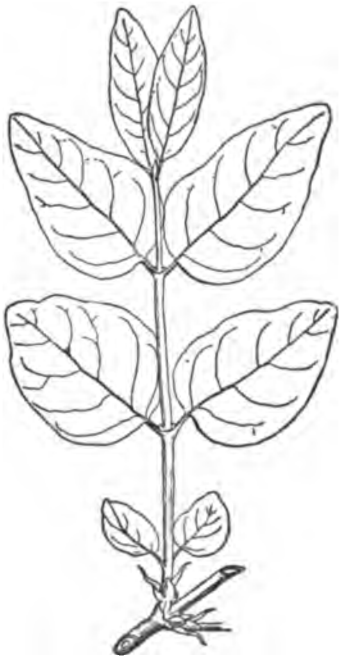
LÒNAS (possibly a recombination of some of the letters of Santolina). *Compósitæ.* This includes an unimportant, hardy, yellow-flowered "everlasting" known to the trade as the African Daisy or *Athanasia annua.* The heads are about three-eighths of an inch across, and composed entirely of disk fls. There are 14 or more heads in the largest corymb, which may be 2 in. across. This plant was removed from Athanasia largely because it is an annual herb, while the Athanasias are shrubs or subshrubs. A more fundamental reason for giving this plant a separate genus is that it has a cup-shaped pappus, while in Athanasia the pappus is absent or consists of small, rather bristly chaff or else of hyaline hairs.

inodòra, Gærtn. (*Athanàsia ánnua*, Linn.). AFRICAN DAISY. Fleshy, branching, 1 ft. high: lvs. alternate, pinnatifid, the divisions linear, entire, remote: corymbs dense: seeds 5-ribbed, not hairy. Mediterranean region. B.M. 2276. J.H. III. 31:281.

LONDON PURPLE. See *Insecticides.*

LONGWORTH, NICHOLAS (1783–1863) has been called the "father of American grape culture." Plate X. He was born in Newark, N. J. He early went to Cincinnati, then in the young and growing West, and engaged in banking and other business. He early became interested in agricultural affairs, and particularly in the grape. From John Adlum he received the Catawba, and became the means of making grape-growing a commercial success in the Ohio valley. He was a leader in the company of horticultural experts and writers which made Cincinnati famous in the middle of the century. Longworth was one of the first to perceive that many strawberries are infertile with themselves, and to suggest the planting of pollinizers, although the imperfect nature of the strawberry blossom had been known long before his time. He also introduced the Ohio Everbearing raspberry, the first improved variety of *Rubus occidentalis.* Longworth was a pioneer of horticulture in the expanding West, and, more than that, he was a guiding spirit in horticultural affairs of national importance. In 1846 he published a pamphlet on "The Cultivation of the Grape, and Manufacture of Wine. Also, Character and Habits of the Strawberry Plant." He also contributed a chapter on the strawberry to Buchanan's "Culture of the Grape." For further notices, see Hovey's "Magazine of Hort." 29:160, "Evolution of Our Native Fruits," and our article on *Horticulture.* The portrait in Plate X shows Mr. Longworth at 74 years of age. L. H. B.

LONÍCERA (after Adam Lonicer or Lonitzer, a German physician and naturalist, 1528–1586). Including *Caprifòlium, Xylósteum, Nintòa* and *Chamæcérasus. Caprifoliàceæ.* HONEYSUCKLE. Ornamental deciduous, rarely evergreen, shrubs of upright or climbing habit, with opposite, entire lvs. and tubular, mostly 2-lipped fls. of white, yellow, pink, scarlet or purple color, often fragrant, appearing in axillary pairs or in terminal spikes or clusters; the red, yellow, blue or black berries are in many species very decorative. The Upright or Bush Honeysuckles are very valuable for shrubberies, and the low procumbent species, like *L. spinosa* and *rupicola*, are well suited for rockeries. Most of the cultivated species are hardy North, but *L. Standishi, fragrantissima, nummularifolia, Ledebouri, quinquelocularis, Webbiana, rupicola*, and other Himalayan species are less hardy and need sheltered positions or protection North. Some of the handsomest in bloom are the well-known *L. Tatarica, floribunda, spinosa, Maackii, Morrowi, Ledebouri;* for the sweet-scented early fls., *L. Standishi* and *fragrantissima* are to be recommended. Honeysuckles with very decorative fruits are *L. Morrowi, Tatarica, gracilipes, alpigena, chrysantha.* Loniceras thrive in almost any good garden soil, and prefer mostly sunny position, but *L. ciliata, nigra, Ledebouri, hispida* and *Xylosteum* grow as well or better in partly shaded situations. Pruning may be done during winter except in the early-flowering species, like *L. Standishi, fragrantissima, gracilipes* and *hispida.* The Climbing Honeysuckles are well adapted for covering walls, arbors and other trelliswork; they have mostly handsome and often sweet-scented fls., but are somewhat deficient in foliage, with the exception of *L. Japonica*, and apt to become leafless and unsightly at the base, and therefore may be mixed with other climbers, like Ampelopsis, Akebia, Clematis. They perhaps show their beauty to the best advantage when allowed to ramble over shrubs and small trees. Those of the Caprifolium group are mostly hardy North, with the exception of the southern European species and *L. hispidula*, while of the Nintoa group *L. Japonica* is hardy North, at least in a sheltered position; this species makes also a very handsome ground cover, and, like *L. Periclymenum*, grows well in shade, but the others prefer sunny positions. Prop. by seeds sown in fall or stratified and by cuttings of ripened wood; also by green-wood cuttings under glass in summer, but *L. Caprifolium, sempervirens* and allied species grow less readily in this way. *L. spinosa* is sometimes grafted high on stems of *L. Tatarica*, thus forming a small weeping tree. About 140 species throughout the north-



1311. Fly Honeysuckle, Lonicera ciliata.

(×⅜.)

ern hemisphere, more than 60 of which, besides many hybrids, are in cultivation. Lvs. sometimes sinuately lobed, in a few species with distinct stipules, mostly deciduous: fls. in axillary peduncled pairs or in sessile whorls at the end of the branches; calyx 5-toothed; corolla with short or slender, often gibbous tube, 2-lipped or almost equally 5-lobed; stamens 5: ovary inferior, usually 2–3-celled: berry few- to many-seeded.

INDEX.

alba, 17, 26.
Alberti, 1.
alpigena, 12.
angustifolia, 17.
aureo-reticulata, 19.
Belgica, 22.
brachypoda, 19.
Browni, 30.
Californica, 34.
Canadensis, 8.
Caprifolium, 25, 26.
Caucasica, 13.
Chinensis, 19.
ciliata, 8.
ciliosa, 35.
cærulea, 6.
dioica, 33.
Douglasi, 32.
Etrusca, 23, 25.
flava, 28, 30.
flava nova, 36.
flavescens, 3.
flexuosa, 19.
floribunda, 18.
Fraseri, 28.
fragrantissima, 11.
fuchsioides, 36.
gigantea, 23.
glauca, 33.
glaucescens, 32.
graciliflora, 6.
gracilipes, 7.
gracilis, 17.
grandiflora, 17.
grata, 26.
Halleana, 19.
Heckrotti, 24.
Hildebrandiana, 21.
hirsuta, 34.
hispida, 5.
hispidula, 32.
implexa, 27.
intermedia, 4.
involucrata, 3.
Italica, 25.
Japonica, 19.
Karelini, 6.
latifolia, 17.
Ledebouri, 4.
longiflora, 20.
Magnevillea, 36.
media, 33.
minor, 36.
Morrowi, 15.
Niaguarilli, 11.
oblongifolia, 9.
occidentalis, 35.
orientalis, 13.
pallida, 26.
parvifolia, 17 and suppl.
parviflora, 33.
perfoliata, 26.
Periclymenum, 22.
Phylomelæ, 7.
Plantierensis, 30.
præcox, 26.
pubescens, 31.
pulcherrima, 17.
quercifolia, 22.
reticulata aurea, 19.
rubella, 25.
rubiflora, 17.
rupicola, 2.
Ruprechtiana, 16.
semperflorens, 22, 36.
serotina, 22.
Sibirica, 17.
Sinensis, 10.
speciosa, 17, 36.
spinosa, 1.
splendens, 17.
Standishi, 10.
Sullivanti, 29.
Tatarica, 17.
vacillans, 34.
villosa, 6.
Xylosteum, 14.

A. *Habit upright: fls. in pairs, rarely solitary.*

B. *Fls. with almost regular 5-lobed limb.*

C. *Corolla not gibbous at the base: low shrubs, with slender, recurving or prostrate branches and small lvs.*

1. **spinòsa**, Jacq. (*L. Albertii*, Regel). Shrub, to 2 ft., with slender branches; rigid and spiny in high alpine regions, glabrous: lvs. linear or linear-lanceolate, sometimes with 2–4 teeth at the base, glaucous or bluish green, ½–1¼ in. long: fls. on slender, erect peduncles, rosy pink, fragrant, with slender tube; stamens exserted. May, June. Turkestan, Himal. Gt. 30:1065. B.M. 7394.

2. **rupícola**, Hook. f. & Thoms Low and almost prostrate: lvs. often in 3's, oblong to oblong-ovate, glabrous or tomentose beneath, about ½ in. long: fls. short-peduncled, light pink, with short tube; stamens and style included. June, July. China, Himal.

CC. *Corolla more or less gibbous: erect shrubs: lvs. larger.*

D. *Bracts at the base of fls. large, ovate or cordate.*

E. *Color of fls. yellow or scarlet.*

3. **involucràta**, Banks (*L. flavéscens*, Dipp.). Shrub, to 3 ft., with upright branches, glabrous or somewhat pubescent: lvs. elliptic-ovate to oblong-lanceolate, bright green, thin, slightly pubescent beneath when young, 2–5 in. long: fls. erect, long-peduncled; corolla yellowish or slightly tinged red, viscid, pubescent, with short erect lobes, about ½ in. long: berries black, shining, almost enclosed by the enlarged purple bractlets. May–July. Ontario to Alaska, south to Utah and Calif. B.R. 14:1179. B.B. 3:242.

4. **Ledebòuri**, Eschsch. (*L. intermèdia*, Kellogg). Similar to the former, but more vigorous, branches sometimes sarmentose, to 15 ft. long: lvs. of firmer texture, dark green above, pubescent beneath: fls. more salver-shaped, with rounded, spreading lobes, scarlet-red outside, ¾ in. long; stamens shorter than lobes. May–July. Calif. Gt. 2:64. R.H. 1843:373.—Much handsomer than the former, but more tender.

EE. *Color of fls. white.*

5. **híspida**, Pall. Shrub, with spreading branches, bristly-hispid: winter-buds large, 2-valved: lvs. obovate to oblong, ciliate and hirsute, at least when young, sometimes glaucous beneath, 1½–2½ in. long: fls. nodding, white, salver-shaped, hisid, 1–1½ in. long: bractlets none: fr. oblong, bright red. April, May. Altai. Himalayas.—Distinct and handsome with its rather large white flowers.

DD. *Bracts small and narrow.*

6. **cærùlea**, Linn. Much-branched erect or spreading shrub, to 3 ft., with glabrous or pubescent branchlets: lvs. often stipulate oval or obovate to oblong-lanceolate, pubescent or almost glabrous, pale or glaucous green, 1–2 in. long: fls. short-peduncled, yellowish or greenish white, ⅓–½ in. long: fr. blue, bloomy; berries connate only at the base, but wholly covered by the connate bractlets and hence seemingly connate. April, May. N. Eu., N. Asia and in N. America south to Tenn., Wis. and Calif. B.M. 1965.—Var. **villòsa**, Torr. & Gr. Branchlets and lvs. villous pubescent. Var. **gracilifiòra**, Dipp. (*L. Karelìni*, Hort., not Bge.). With upright rather slender, bright red branches, slightly pubescent: fls. with slender tube.

7. **gracílipes**, Miq. (*L. Phylomèlæ*, Hort.). Shrub, to 6 ft., almost glabrous: lvs. roundish-ovate to oblong-ovate, ciliate, bright green often with reddish margin, 1–2½ in. long: peduncles slender, nodding, usually 1-fld.: corolla pink, rarely white, ⅔ in. long: fr. rather large, pendulous, bright red. April, May. Japan. G.F. 10:265.—A graceful species; one of the earliest to bloom, and very handsome in June with its pendulous scarlet fls.

8. **ciliàta**, Muhlenb. (*L. Canadénsis*, Marsh.). Fig. 1311. Shrub, to 5 ft.: lvs. ovate or oval, rounded or cordate at the base, ciliate, pubescent beneath when young, 1½–3 in. long: fls. slender-peduncled, always in pairs, yellowish, sometimes slightly tinged red, ⅔ in. long: fr. light red. April, May. Canada to Pa. and Mich. B.B. 3:241.

BB. *Fls. 2-lipped.*

C. *Ovaries and frs. connate or partly connate, only occasionally separate: fls. rather small.*

D. *Bractlets none: fls. white or yellowish.*

9. **oblongifòlia**, Hook. Shrub, to 5 ft.: lvs. almost sessile, oval-oblong, obtuse, pubescent beneath, 1–2½ in. long: fls. slender-peduncled; corolla hairy outside, yellowish white, sometimes tinged purplish: berries dark red. May, June. Quebec to Manitoba, south to Pa. and Mich. B.B. 3:240.

1312. Lonicera Xylosteum (× ⅓).

10. **Stándishi**, Carr. (*L. Sinénsis*, Hort. *L. fragrantíssima*, Lindl.). Half-evergreen shrub, with spreading branches, to 6 ft.: branchlets with reflexed bristly hairs: lvs. coriaceous, oblong-ovate to ovate-lanceolate, acuminate, ciliate, bristly hairy on both sides or glabrous above, 3–4 in. long: fls. on rather short curved peduncles, white or slightly blushed, very fragrant, ¼–½ in. long: fr. scarlet. March, Apr. China. B.M. 5709. G.C. III. 5:245. R.H. 1873, p. 148.

11. **fragrantissima**, Carr. (*L.*, or *Caprifolium, Niaguarilli*, Hort.). Similar to the former, but with long and slender recurving and almost glabrous branches: lvs. broadly ovate or obovate, acute, almost glabrous, but bristly on the midrib beneath and ciliate, 1-2½ in. long: corolla glabrous outside. March-May. G.C. III. 5:245. R.H. 1873, p. 169.—Less hardy than the former. Both have handsome half-evergreen foliage and very early, sweet-scented, though not very showy flowers.

DD. *Bractlets present, small, glandular: fls. dull violet or brownish red.*

12. **alpigèna**, Linn. Shrub, to 8 ft., with stout branches: lvs. oblong-obovate or oblong, short acuminate, glossy and dark green above, light green and often pubescent beneath, 2-4 in. long: fls. long-peduncled, with short usually yellowish green tube and brownish red limb: fr. bright scarlet, shining. April, May. Mts. of M. Eu. and W. Asia.—Very handsome in fruit.

1313. Lonicera Tatarica (× ⅓).

13. **orientàlis**, Lam. (*L. Caucásica*, Bieb.). Shrub, to 10 ft., almost glabrous: lvs. elliptic or ovate to oblong-ovate, rarely oblong-lanceolate, dark green above, pale or glaucescent beneath, 2-4 in. long: fls. short-peduncled, pale violet or pinkish: fr. black, wholly connate. May, June. W. Asia to Kamschatka. Gt. 11:359. —Fls. and frs. not very conspicuous.

CC. *Ovaries and frs. separate.*

D. *Fls. white or yellowish white, changing to yellow: branches pubescent.*

14. **Xylósteum**, Linn. Fig. 1312. Shrub, to 10 ft.: lvs. broadly oval to obovate, acute, dull green, pubescent above, usually glabrous at length, 1-3 in. long: fls. peduncled, yellowish white, often slightly tinged red, hairy outside: bractlets pubescent, about half as high as ovary: berries dark red. May, June. Eu., W. and N. Asia, sometimes escaped from cultivation. B.B. 3:241.

15. **Mórrowi**, Gray. Shrub, to 6 ft., with wide spreading branches: lvs. oval or oblong-ovate, dark green above, grayish tomentose beneath, 1-2 in. long: fls. peduncled, pure white at first, pubescent outside, upper lip divided nearly to the base, with spreading lobes: bractlets pubescent, about as long as ovary: fr. blood-red. May, June. Japan. A.F. 11:1267. Gng. 5:329.—Very decorative, with its bright red fruit from August until late in fall. There is also a var. with yellow fruit.

16. **Ruprechtiàna**, Regel. Shrub, to 12 ft.: lvs. ovate-lanceolate to lanceolate, acuminate, usually dark green above, grayish pubescent beneath, 2-4 in. long: fls. on rather long peduncles, pure white at first, glabrous outside: bractlets only glandular-ciliate, small, about one-third of the ovary: fr. red or sometimes yellow. May, June. Manshuria. Gt. 19:645.—This species and the preceding are likely to hybridize with the following; these hybrids are very common, and may be recognized by the glabrescent foliage and the tinge of pink in the fls. The true *L. Ruprechtiana* is much rarer than its hybrids.

DD. *Fls. pink or red, sometimes white, but not changing to yellow.*

17. **Tatárica**, Linn. Fig. 1313. Shrub, to 10 ft., almost glabrous: lvs. cordate or rounded at the base, ovate to ovate-lanceolate, ciliate, sometimes slightly pubescent beneath when young, 1-2½ in. long: fls. slender-peduncled, pink, crimson or white, the upper lip deeply divided, spreading: bractlets small, glabrous: fr. red, rarely yellow. May, June. S. E. Russia to Siberia. B.R. 1:31. R.H. 1868:392. Gt. 18:627.—Variable in size and shade of fls. Var. **álba**, Regel (var. *alba grandiflora*, Hort.). Fls. white, large. Var. **angustifòlia**, Kirchn. (*L. angustàta*, Wender.). Lvs. narrow-lanceolate: fls. bright pink. Var. **latifòlia**, Loud. (var. *grandiflòra* and var. *grandiflòra rùbra*, Hort.; var. *speciosa*, var. *pulcherrima*, Hort.). Large-leaved form, with large pink fls., the lobes bordered lighter pink. R.H. 1844:109. A form of this with deeper pink fls. is var. **speciòsa**, Carr. (var. *spléndens*, Regel). R. H. 1868:392. Gt. 18:627. Var. **parvifòlia**, Jäger (var. *grácilis*, Carr.; *L. parvifòlia*, Hayne, not Edgew.). Lvs. smaller, obtuse: fls. pure white, small, with broad and short lobes: fr. orange-red. Var. **rubiflòra**, DC. (*L. Sibírica*, Hort.). Fls. deep pink.

18. **floribúnda**, Boiss. & Buhse. Shrub, to 8 ft.; finely tomentose: lvs. roundish ovate to oval, obtuse, pubescent on both sides, bluish or grayish green, ½-1½ in. long: fls. slender-peduncled, light pink, upper lip divided (not beyond the middle), with ovate erect lobes: bractlets small, pubescent: fr. red. June. Transcauc., Persia. Gt. 42, p. 103, Figs. 4-6.—Very free-flowering shrub, with distinct, bluish green foliage.

AA. *Habit climbing, rarely almost shrubby.*

B. *Fls. in pairs, 2-lipped, sometimes crowded at the end of branches; tube slender.* (*Nintoa.*)

19. **Japónica**, Thunb. Fig. 1314. Climbing, to 15 ft. high: branchlets usually pubescent when young: lvs. half-evergreen, roundish ovate to oblong, pubescent beneath or almost glabrous, 1½-3 in. long: fls. short-pedicelled, white, changing to yellow, often purplish outside, very fragrant, glandular-pubescent outside, 1½-2 in. long: fr. black, separate. June-Aug. China, Japan; naturalized in some places from N. Y. to N. C. B. B. 3:240.—Var. **àureo-reticulàta**, Arb. Kew. (*L. reticulàta àurea*, Hort. *L. brachýpoda reticulàta*, Hort.). A form of var. *flexuosa*, with the smaller and shorter lvs. handsomely netted yellow. B.H. 21:59. Var. **flexuòsa**, Arb. Kew. (*L. flexuòsa*, Thunb. *L. brachýpoda*, DC.). Less high climbing: lvs. ovate or oblong, obtusish, mostly only pubescent on the veins beneath: peduncles usually as long as petioles or shorter: corolla 1-1½ in. long, with the limb shorter than tube: bractlets broad, as long as ovary. Var. **Chinénsis**, Bak. (*L. Chinénsis*, Wats.). Lvs. ovate, acute, ciliate and pubescent only at the veins beneath, often with purplish hue beneath: peduncles usually longer than petioles: corolla 1½-2 in. long, tube about as long as limb: bractlets narrow, about half as long as ovary. B.R. 9:712. B.M. 3316. L.B.C. 11:1037. Var. **Halliàna**, Arb. Kew. (*L. flexuòsa Halliàna*, Dipp. *Caprifòlium Halliànum*, Hort.). Of vigorous growth: lvs. usually pubescent on both sides when young, oblong-ovate, acute, to 2½ in. long: fls. short-peduncled; tube as long as limb: bractlets broad, half as long as ovary. Flowering in fall, otherwise hardly different from the type. A.G. 12:663. Gng. 3:293.

1314. Lonicera Japonica (× ⅓).

Commonly known in this country as *L. Halliana*.

20. **longiflòra,** DC. Climbing shrub, glabrous: lvs. oblong-lanceolate, shining above, pale beneath, 2–2½ in. long: fls. in short-peduncled pairs, sometimes crowded towards the end of branches; corolla white, changing to yellow, fragrant, 3–4 in. long, with very slender tube: bracts small, subulate: fr. white. S. China. B.R. 15:1232 (as *Caprifolium longiflora*).—Tender. Int. 1900, by Franceschi.

21. **Hildebrandiàna,** Coll. & Hemsl. Climbing shrub, glabrous: lvs. broadly ovate or elliptic-ovate, abruptly pointed, 4–6 in. long: fls. on stout peduncles; corolla 5–7 in. long, glabrous outside, yellow at first, changing to orange-red, with long and slender tube. Summer. Upper Burma. G. C. III. 24:219. B. M. 7677.—This has the largest flowers of any species, but is not hardy North.

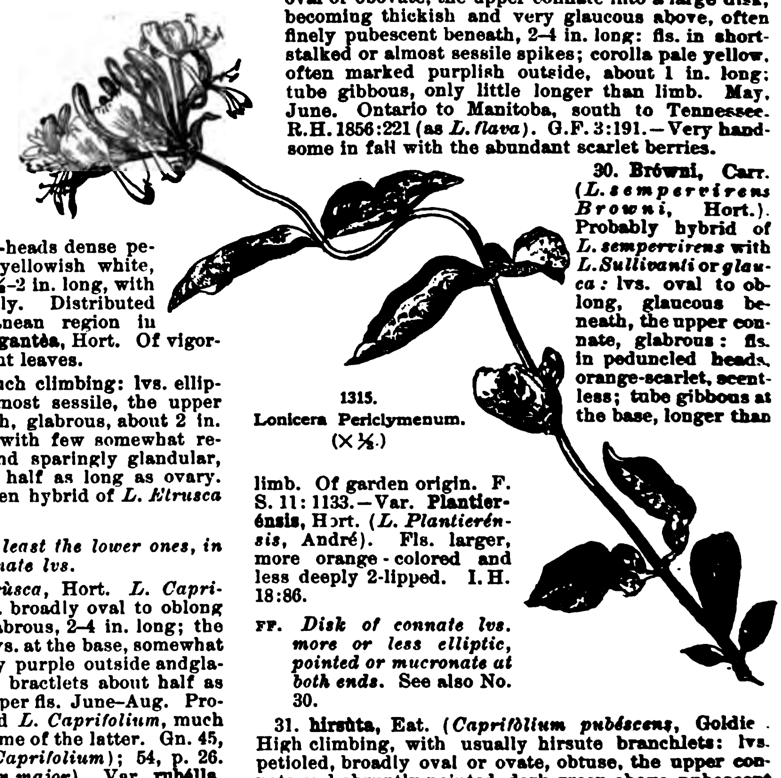
BB. *Fls. sessile, in usually 6-fld. whorls at the end of the branchlets, forming terminal spikes or clusters: upper lvs. mostly connate, usually climbing. (Caprifolium.)*

C. *Corolla distinctly 2-lipped.*

D. *Tube of corolla slender, 1 in. or more long, glabrous inside except No. 27: corolla never bright yellow.*

E. *Whorls of fls. forming a peduncled head or spike: bractlets large.*

22. **Periclýmenum,** Linn. (*Caprifòlium Periclýmenum*, Roem. & Schult.). WOODBINE. Fig. 1315. Climbing several ft. high: lvs. all distinct, ovate to oblong-ovate, acute, 1½–3 in. long, dark green above, pale or glaucous beneath and sometimes sparingly pubescent: fls. in a peduncled dense head, very fragrant, yellowish white, usually carmine or purple outside and glandular pubescent, 1½–2 in. long. June–Sept. Eu., N. Afr., W. Asia.—Var. **Bélgica,** Ait. Of more vigorous growth, sometimes shrubby: fls. bright red outside; blooming all summer. Probably var. **sempérflorens,** Hort., figured in Gn. 45:306, is not very different. Var. **quercifòlia,** Ait. Lvs. sinuately lobed; a curious but less desirable form. Var. **serótina,** Ait. Similar to var. *Belgica*, but flowering in fall.



1315.
Lonicera Periclymenum.
(X ½.)

23. **Etrúsca,** Santi. Climbing: lvs. broadly oval to obovate, usually obtuse, the upper ones connate into an oval obtuse disk, rarely distinct, 1–3 in. long, glabrous or pubescent: fl.-heads dense peduncled, often in 3's: corolla yellowish white, usually tinged red, fragrant, 1½–2 in. long, with very slender tube. May–July. Distributed through the whole Mediterranean region in many different forms.—Var. **gigantèa,** Hort. Of vigorous growth, with large pubescent leaves.

24. **Heckrótti,** Hort. Not much climbing: lvs. elliptic or oblong-elliptic, acute, almost sessile, the upper pairs connate, glaucous beneath, glabrous, about 2 in. long: fls. in peduncled spikes with few somewhat remote whorls, purple outside and sparingly glandular, 1½–2 in. long: bractlets about half as long as ovary. Origin unknown, probably garden hybrid of *L. Etrusca* and an American species.

EE. *Whorls of fls. all, or at least the lower ones, in the axils of connate lvs.*

25. **Itálica,** Schmidt (*L. Etrùsca*, Hort. *L. Caprifòlium*, Auth.). Climbing: lvs. broadly oval to oblong obovate, the upper connate, glabrous, 2–4 in. long; the upper whorls without connate lvs. at the base, somewhat crowded: fls. yellowish, usually purple outside and glabrous, fragrant, to 2 in. long: bractlets about half as long as ovary, smaller on the upper fls. June–Aug. Probably hybrid of *L. Etrusca* and *L. Caprifolium*, much cultivated, mostly under the name of the latter. Gn. 45, p. 307 (as *L. Etrusca* and *L. Caprifolium*); 54, p. 26. F.S. 11:1120 (as *L. Caprifolium major*). Var. **rubélla,** Tausch. Fls. dark purple outside.

26. **Caprifòlium,** Linn. (*Caprifòlium horténse*, Lam. *C. perfoliàtum*, Rochl.). Fig. 1316. Climbing: lvs. oval to oblong, the upper connate into a roundish cup, almost glabrous, 2–4 in. long: whorls usually 2 or 3, each in the axils of connate lvs.: fls. yellowish white, mostly purplish outside and often slightly hairy, to 2 in. long, fragrant: bractlets very small or none. May, June. M. Eu. to W. Asia. N. 2:296. B.B. 3:237.—Sometimes escaped from cultivation and described under the name *L. grata*, Ait., as an American species. Var. **álba,** Ait. (*L. pállida*, Hort. *L. præcox*, Hort.). Fls. white, appearing early. R.H. 1856:141.

27. **impléxa,** Ait. Much branched but less high climbing, evergreen: lvs. oval to oblong-lanceolate, sessile, the upper connate into an elliptic, acute or mucronate disk, glaucous, glabrous, 1–2 in. long: fls. in several whorls, each in the axils of connate lvs., scentless, yellowish white; tube slightly hairy within; limb rather short; stamens little exserted. May, June. S. Eu., N. Afr. B.M. 640.

DD. *Tube of corolla gibbous or more or less ventricose, less than 1 in. long, pubescent within, but almost glabrous within and slender in No. 28.*

E. *Bractlets small or none.*

F. *Disk of connate lvs. mostly roundish, often emarginate at the ends.*

28. **flàva,** Sims (*Caprifòlium Fràseri*, Pursh). Climbing to 10 ft.: lvs. broadly oval to elliptic, the upper connate, bright green above, glaucous beneath, glabrous, 1½–3 in.: fls. in a peduncled head, bright or orange-yellow, fragrant, 1–1¼ in. long; tube slender, longer than limb. April, May. N.C. to Ky., Ga. and Alab. B.M. 1318. L.B.C. 4:338. G.F. 3:190. Gn. 45, p. 307.—This species is rare in cultivation and mostly the following is cult. under this name.

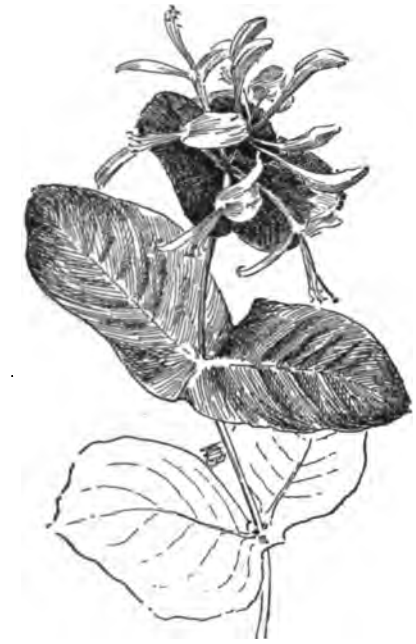
29. **Súllivanti,** Gray (*L. flàva*, Auth., not Sims). Fig. 1317. Climbing about 4–5 ft., very glaucous: lvs. oval or obovate, the upper connate into a large disk, becoming thickish and very glaucous above, often finely pubescent beneath, 2–4 in. long: fls. in short-stalked or almost sessile spikes; corolla pale yellow, often marked purplish outside, about 1 in. long; tube gibbous, only little longer than limb. May, June. Ontario to Manitoba, south to Tennessee. R.H. 1856:221 (as *L. flava*). G.F. 3:191.—Very handsome in fall with the abundant scarlet berries.

30. **Brówni,** Carr. (*L. sempervirens Browni*, Hort.). Probably hybrid of *L. sempervirens* with *L. Sullivanti* or *glauca*: lvs. oval to oblong, glaucous beneath, the upper connate, glabrous: fls. in peduncled heads, orange-scarlet, scentless; tube gibbous at the base, longer than limb. Of garden origin. F. S. 11:1133.—Var. **Plantierénsis,** Hort. (*L. Plantierénsis*, André). Fls. larger, more orange-colored and less deeply 2-lipped. I. H. 18:86.

FF. *Disk of connate lvs. more or less elliptic, pointed or mucronate at both ends.* See also No. 30.

31. **hirsùta,** Eat. (*Caprifòlium pubéscens*, Goldie). High climbing, with usually hirsute branchlets: lvs. petioled, broadly oval or ovate, obtuse, the upper connate and abruptly pointed, dark green above, pubescent on both sides when young, 2–4 in. long: fls. in short, mostly peduncled spikes, scentless, bright or orange-yellow, pubescent without, about 1 in. long, with the

tube gibbous at the base: ovary and bractlets usually glandular. June, July. Vt. to Manitoba, south to Pa. and Ohio. B.M. 3103. Gn. 45, p. 307.



1316. Lonicera Caprifolium (× ½).

32. **Doúglasi**, Hook. (*L. glaucéscens*, Rydb. *L. glaùca*, var. *Doúglasi*, A. Gray, partly). Climbing: branchlets glabrous: lvs. short-petioled or almost sessile, the upper connate, oval to obovate, glabrous above, pubescent beneath, 1½–3 in. long: fls. in short, almost sessile spikes; corolla yellow, mostly reddish outside and hairy, ¾–1 in. long; tube gibbous, longer than the limb: ovary and bractlets glabrous. May, June. Ontario to the Saskatchewan, south to Pa. and Neb. B.B. 3:238.—Rare in cultivation, but sometimes a hybrid of *L. hirsuta* and *Sullivanti* is found under this name in gardens. It is figured in G.F. 9:345.

33. **dióica**, Linn. (*L. glaùca*, Hill. *L. mèdia*, Murr. *L. parviflòra*, Lam.). Usually shrubby, with slender, sarmentose branches, rarely climbing, glabrous: lvs. short-petioled or almost sessile, the upper connate, oval to oblong, obtuse, with usually undulate and transparent margin, very glaucous beneath, 1½–3 in. long: fls. in sessile or short-stalked spikes, greenish or whitish yellow, often tinged purplish, glabrous outside, ½–¾ in. long, the tube gibbous, about as long as limb. May, June. Quebec to Manitoba, south to Ohio and N. C. B.R. 2:138.

EE. *Bractlets as high as ovary or slightly shorter, roundish.*

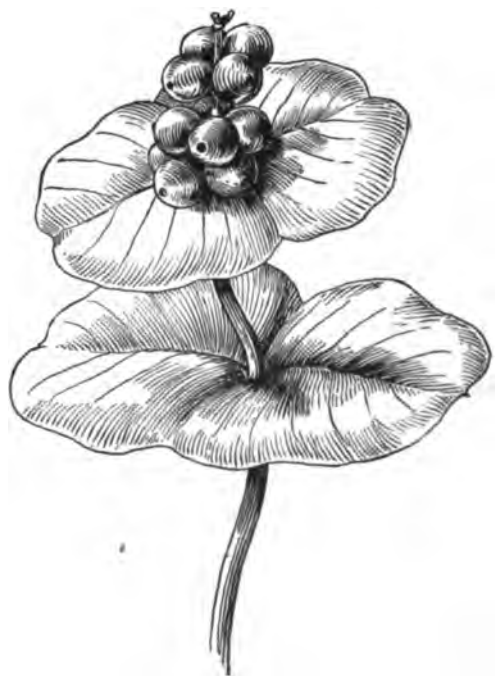
34. **hispídula**, Dougl. Bushy shrub with sarmentose branches, rarely twining, usually hirsute: lvs. oval to ovate, rounded or cordate at the base, often with foliaceous stipules, the upper connate or sometimes distinct, usually small, rarely to 2½ in. long, ciliate and pubescent, rarely glabrous · fls. in slender-peduncled and often panicled spikes, pink or yellowish, glabrous or hirsute, ⅓–½ in. long, with short gibbous tube. June, July. Brit. Columb. to Calif. B.R. 21:1761.—Var **Califórnica**, Greene (var. *vácillans*, A. Gray). Of more vigorous growth, with large lvs. to 3 in. long: corolla glandular-pubescent outside. Calif.

CC. *Corolla with almost regular or slightly 2-lipped limb: limb several times shorter than tube.*

35. **ciliósa**, Poir. (*L. occidentàlis*, Hook.). Low sarmentose shrub: lvs. petioled, ovate or oval, glaucous beneath, glabrous but ciliate, the upper connate, 2–4 in. long: fls. in short-peduncled heads of one or few whorls; corolla slightly 2-lipped, with ventricose-gibbous tube, yellow to orange-scarlet, sometimes hirsute outside, 1¼–1¾ in. long. June, July. Brit. Col. to Calif. and Ariz.

36. **sempérvirens**, Linn. (*Caprifòlium sempérvirens*, Michx.). TRUMPET HONEYSUCKLE. Fig. 1318. High climbing, glabrous; evergreen southward: lvs. oval to oblong, glaucous beneath, the upper connate, 2–3 in. long: fls. in peduncled interrupted spikes; corolla with almost equal limb; tube slightly ventricose, glabrous, 1½–2 in. long, scarlet or orange-scarlet, rarely yellow. May–Sept. Conn. to Fla., west to Neb. and Tex. B.M. 781. R.H. 1856:361. Gn. 45, p. 307.—Var. **flàva**, Regel (*L. flàva nòva*, Hort.). Fls. yellow. Gt. 2:38. Var. **fuchsioides**, Hort. (*L. fuchsioides*, Hort., not of Hemsl., which is a Chinese species of the Nintoa group and not yet introduced). Similar to var. minor, but tube more expanded above, bright scarlet. Var. **minor**, Ait. Lvs. oblong or narrow oblong: fls. more slender, orange-red or orange-scarlet. Very free-flowering; but more tender. B.M. 1753. B.R. 7:556. Gn. 34:300. Var. **speciòsa**, Carr. Differs from the type by more brilliant scarlet fls. F.S. 11:1128. Sometimes cult. as *L. Magnevillea*, a name also applied to *L. dioica*, and a darker red form of *L. Caprifolium*.

L. angustifòlia, Wall. Erect shrub, to 10 ft.: lvs. lanceolate: fls. long-peduncled, white, fragrant, with regular 5-lobed limb. Himal. F.S. 4, pp. 407, 408 *b*. Tender.—*L. arbòrea*, Boiss. Erect shrub or small tree, to 30 ft.: lvs. roundish ovate, pubescent: fls. short-peduncled, 2-lipped, pinkish, small. Spain.—*L. bélla*, Zabel (L. Morrowi × Tatarica). Intermediate between the two: fls. white to pink. Garden origin.—*L. biflòra*, Desf.= L. canescens.—*L. canéscens*, Schousb. Climbing, grayish tomentose: lvs. ovate, small: fls. in pairs, white, 2-lipped, with slender, long tube, fragrant. Spain, N. Afr.—*L. chrysántha*, Turcz. Allied to L. Xylosteum, higher: lvs. larger, acuminate: fls. larger, changing to bright yellow. N. E. Asia. Gt. 12:404. Handsome hardy shrub, with rather light green foliage and bright coral-red berries.—*L. confùsa*, DC. Allied to L. canescens, but fls. and lvs. somewhat larger and ovary glabrous. Japan, China. B.R. 1:70 (as L. Japonica). Gn. 45, p. 307. Has been often confounded with L. Japonica, but is easily distinguished by the small subu-



1317. Lonicera Sullivanti (× ⅔).

1318. Lonicera sempervirens (× ½).

late bracts.—*L. conjugiàlis*, Kellogg. Erect shrub: lvs. oval or ovate, pubescent: fls. slender-peduncled, small, 2-lipped, dark purple. Washington to Calif.—*L. depréssa*, Royle. Low shrub, with small oval to oblong, glabrous lvs.: fls. peduncled, light pink, with short tube and regular limb, small. Himal. Var. Myrtillus, Clarke. Fls. short-peduncled: bracts narrower.—*L. diversifòlia*, Wall. = L. quinquelocularis.—*L. gibbiflòra*, Maxim. = L. chrysantha.—*L. gibbiflòra*, Dipp. Probably hybrid of L. Ruprechtiana and chrysantha; L. notha is also sometimes met with under this name.—*L. Ibérica*, Bieb. Erect shrub, to 8 ft.: lvs. roundish ovate, pubescent: fls. short-peduncled, 2-lipped, small, yellowish: berries bright red. N. Persia, Caucasus.—*L. Kamschática*, Hort. = L. Kesselringi.—*L. Késselringi*, Regel. Closely allied to L. orientalis: lvs. elliptic-lanceolate: fls. with narrow, not gibbous tube. Kamschatka. Gt. 40, p. 124.—*L. Korolkòwi*, Stapf. Closely allied to L. floribunda, but filaments much longer and hairy and upper lip more deeply divided. Persia. G.F. 7:35. Hardy and free-flowering.—*L. Maácki*, Maxim. Shrub, to 10 ft.: lvs. oblong-ovate: fls. short-peduncled, white, fragrant, 2-lipped, about 1 in. long. June, July. N. China, Amurland. Gt. 33:1162. Handsome hardy shrub, flowering after the other Bush Honeysuckles.—*L. Maximòwiczi*, Maxim. Shrub, to 6 ft.: lvs. oblong-elliptic: fls. peduncled, purplish violet, 2-lipped, rather small. N. E. Asia. Gt. 17:597.—*L. micrántha*, Regel = L. floribunda.—*L. micrántha*, Dipp. Hybrid of L. Tatarica and Xylosteum: of no decorative value. Garden origin.—*L. microphýlla*, Willd. Erect shrub, to 3 ft.: lvs. oval, about ½ in. long: fls. slender-peduncled, 2-lipped, yellowish white, small: berries connate, orange-red. Altai to Himal.—*L. Mundeniénsis*, Rehder (L. bella × Ruprechtiana). Lvs. oblong-ovate, dark green above: fls. white. Garden origin. Gt. 42, p. 101, Figs. 4–6.—*L. Muscaviénsis*, Rehder (L. Morrowi × Ruprechtiana). Similar to L. Morrowi, but of more upright and vigorous habit. Garden origin. Gt. 42, p. 101, Figs. 1–3.—*L. Myrtíllus*, Hook. f. & Thoms. = L. depressa vars.—*L. nervòsa*, Maxim. Shrub, to 10 ft., with slender dark purple branchlets: lvs. ovate, with purple veins: fls. small, pink, long-peduncled, 2-lipped: fr. black. China. Hardy, graceful shrub.—*L. nígra*, Linn. Shrub, to 5 ft.: lvs. elliptic to elliptic-lanceolate: fls. slender-peduncled, pink, small: fr. black. Mts. of M. Eu.—*L. nòtha*, Zabel (L. Ruprechtiana × Tatarica). Intermediate between the two: fls. white to pink. Garden origin.—*L. nummulariifòlia*, Jaub. & Spach. Similar to L. floribunda, but fls. short-peduncled or almost sessile. W. Asia to Afghan.—*L. obovàta*, Royle. Similar to L. microphylla: lvs. very small, obovate: fls. small, with almost regular limb, yellowish white. Himal.—*L. parvifòlia*, Edgew. = L. depressa.—*L. propínqua*, Zabel (L. alpigena × Ledebouri). An interesting hybrid, in one form more like the first, in the other more like the second parent. Of garden origin.—*L. Pyrenàica*, Linn. Erect shrub, almost glabrous: lvs. cuneate-oblong: fls. slender-peduncled, tubular-campanulate, regularly 5-lobed, white, ¾ in. long. Pyren. Mts.—*L. quinqueloculàris*, Hardw. Shrub, to 10 ft., with slender, spreading branches, similar to L. Xylosteum: fls. almost sessile, larger, yellowish: berries white. Himal. B.R. 30:33 (as L. diversifolia).—*L. Regeliàna*, Dipp. Probably hybrid of L. chrysantha and Xylosteum.—*L. Schmitziàna*, Dipp., not Roezl = L. orientalis.—*L. Segreziénsis*, Lav. Closely allied to L. Xylosteum: lvs. more pubescent, dark bluish green: fls. short-peduncled, yellowish. Supposed to be a hybrid of L. quinquelocularis and L. Xylosteum.—*L. spléndida*, Boiss. Allied to L. implexa and Etrusca: glabrous, glaucous: fls. in a many-fld., sessile head, yellowish white, tinged purple. Spain. F. S. 11:1130.—*L. Tangùtica*, Maxim. Slender shrub, with small, obovate or oblong lvs.: fls. slender-peduncled, small, with 5-lobed limb, pale pink. China. Gt. 40, p. 581.—*L. tomentélla*, Hook. f. & Thom. Erect shrub, to 12 ft.: lvs. small, ovate to oblong, pubescent: fls. short-peduncled, nodding, small, regular, white. Himal. B.M. 6486. Tender.—*L. translùcens*, Hort. = L. quinquelocularis.—*L. Webbiàna*, Wall. Allied to L. alpigena. Lvs. larger, acuminate, pubescent: fls. paler: ovaries separate. S. E. Eu. to Himal.—*L. Zàbeli*, Rehder. Allied to L. floribunda, but quite glabrous and lvs. somewhat larger. Probably hybrid of L. floribunda and Tatarica. Gt. 42, p. 103, Figs. 1–3. Very free-flowering and handsome.

ALFRED REHDER.

LOOSESTRIFE. See *Lysimachia* and *Lythrum*.

LOPÈZIA (after the Spaniard Lopez, who wrote on the natural history of the New World). *Onagràceæ*. About 21 species of herbs from Mexico and Central America. Erect, branching, glabrous or pubescent: lvs. alternate or the lower opposite, dentate: fls. usually small, in leafy racemes or subcorymbose at the ends of branches, slender-pedicelled; calyx limb 4-parted, inequal, deciduous, linear-lobed; petals 4, short- or long-clawed, inequal, the posterior ones narrower, the claws glandular at the apex; stamens 2, attached to the pistil, one anther-bearing, the other petal-like: ovary 4-celled: capsule globose, leathery: seeds obovoid, with a leathery, granulated coat.

albiflòra, Schlecht. Fig. 1319. Suffruticose, diffuse, 2 ft. high: young branches somewhat villous: lvs. cuneate at the base, ovate-lanceolate, irregularly serrate or remotely dentate, largest 1½ in. long: pedicels horizontally spreading, slender: petals white, often tinged slightly pinkish at base, larger ones obliquely spatulate, obtuse and mostly notched, smaller ones linear, obtuse, as long as sepals. Mex.—Cult. at Harvard Botanic Garden, where the plant differs from the original description by the lvs. being usually ovate or perhaps oblong-ovate, and the smaller petals longer than the sepals. It seems to flower through the winter.

1319. Lopezia albiflora (× ½).

coronàta, And. Annual: lvs. scattered or in whorls, glossy, glabrous: two upper petals linear, bright lilac; two side ones larger; lamina roundish obovate, light lilac, with dark red mark at base. Mex. S.B.F.G. I. 2:108.—Cult. in S. Calif.

LOPHÁNTHUS (Greek, *crested flower;* application not evident). *Labiàtæ.* Of this genus we cultivate 2 species of hardy herbaceous perennials, which are rather tall and coarse and bear spikes of more or less purplish fls. in summer. The genus contains 7 species, all from America or N. E. Asia. Lvs. serrate, veiny, petioled, lower usually subcordate and upper ovate: fls. small, in dense sessile whorls crowded into terminal spikes, which may be interrupted below; stamens exserted; anthers separated or distant, not approximate in pairs, their cells parallel or nearly so. Of minor value.

anisàtus, Benth. GIANT HYSSOP. Height 2–3 ft.: lvs. ovate, anise-scented when crushed, white beneath: fls. blue; calyx teeth tinged purple or violet. July, Aug. Prairies, Wis. to Rockies. B.R. 15:1282.—This species grows 3–5 ft. high, on dry hills, and has pale purple flowers.

scrophulariæfòlius, Benth. Height 4–6 ft.: lvs. not anise-scented, not white beneath: fls. dull purplish; calyx teeth whitish. Borders of thickets, N. Y. to Wis. and N. C.—This plant grows 2 ft. high and has lavender-blue flowers in June.

LOPHOSPÉRMUM. See *Maurandia.*

LORDS AND LADIES. *Arum maculatum.*

LOQUAT. See *Eriobotrya Japonica.*

LÒTUS meant several things to the ancients: (1) the Greek Lotus, a leguminous plant on which horses fed. This was probably what we call to-day *Lotus corniculatus*, the common Bird's-foot Trefoil of temperate regions. (2) the Cyrenean Lotus, an African shrub, the fruit of which was eaten by certain North African tribes who were called Lotus eaters. The fruit was said to be honey-sweet, the size of an olive and in taste like a date. This was probably *Zizyphus Lotus*, a prickly shrub whose fruit is, however, considered inferior to that of the common jujube, *Zizyphus sativa*. Other conjectures have been: *Celtis australis*, a tree which has a small, sweet berry; *Nitraria tridentata*, a thorny desert shrub whose succulent fruit has a stimulating quality, and *Rhamnus Lotus*, another North African plant. European Lotus is a name for *Diospyros Lotos*, a kind of date plum which is cult. in S. Eu., but the fruit is hardly edible. (3) The Egyptian Lotus or Sacred Lily of the Nile. This is *Nymphæa Lotus*, which, like the Hindu Lotus, has rose-colored as well as white flowers. American cultivators at the present time almost universally consider that the true Egyptian Lotus is *Nelumbium speciosum*, now called *Nelumbo*, but *Nelumbium speciosum* is not a native of Egypt. (4) The Hindu and Chinese Lotus, also called the Sacred or Pythagorean Bean. This is *Nelumbo Indica*, better known as *Nelumbium speciosum*. The name Lotus was doubtless used for other water lilies, particularly the blue-flowered *Nymphæa cærulea*. These plants are described in this work. See *Nelumbo* and *Nymphæa*.

Lotus of the botanists is a genus of 50–100 species, found in temperate regions: herbs or subshrubs, glabrous, silky or hirsute: lvs. with 3 lfts. crowded at the apex of the petiole and commonly 2 joined to the stem and resembling stipules: fls. pea-shaped, yellow, red, rosy or white, often in axillary, few-fld. umbels, rarely solitary; calyx lobes longer than the tube; keel beaked: pod oblong or linear. Leguminosæ.

A. *Lvs. thread-like: fls. odd, not pea-shaped.*

Bertholètii, Masf. (*L. peliorhýncus*, Hook. *L. pelyorensis*, Hort.). Small, much-branched, slender bush, with a silvery hue: lfts. whorled, 8–9 lines long: fls. 1½ in. long, in loose clusters of about 20 toward the end of the branches, short-pedicelled, scarlet or crimson fading to orange; standard recurved like a horn; keel acuminate, longer than the wings. Cape Verde, Canaries. B.M. 6733. R.H. 1895:308.—Peliorhyncus means bruised or discolored nose. Called "Coral Gem" in catalogues. Grown chiefly in hanging baskets. Prop. by division or cuttings.

AA. *Lvs. not thread-like: fls. pea-shaped.*

B. *Fls. yellow.*

corniculàtus, Linn. BIRD'S-FOOT TREFOIL. BABIES' SLIPPERS. Perennial, prostrate or ascending, a few in. to 2 ft. high, glabrous or hairy: lfts. obovate or ovate, ½ in. long, the 2 stipular ones broader and very oblique: fls. yellow, often tinged bright red, 5–10 in an umbel; calyx lobes about as long as the tube. Temp. regions and Australia. Var. **flòre-plèno** has showy double fls.—A hardy trailer for covering dry banks and rockwork, blooming all summer and autumn. Also grown for forage.

BB. *Fls. pink or white.*

austràlis, Andr. Perennial, diffuse, sometimes subshrubby, glabrous or pubescent: lfts. narrower than in *L. corniculatus*, and the stipular ones less dissimilar, but varying from obovate and under ½ in. long, to linear and 1–1½ in. long: fls. usually pink, but varying from white to purple-red. Australia. B.M. 1365. L.B.C. 11:1063 and B. 5:211 (as *L. albidus*).—Int. 1900 by Franceschi.

BBB. *Fls. dark purple or dark red.*

C. *Lfts. linear-lanceolate.*

Jacobæus, Linn. Perennial, subshrubby: fls. about 3 in a flat-topped cluster, dark purple, almost black. Cape Verde. B.M. 79.—Treated as a tender annual bedding plant.

CC. *Lfts. obovate to elliptic.*

Tetragonólobus, Linn. WINGED PEA. Annual trailer: fls. solitary or twin, purplish cardinal-red. Mediterranean region. B.M. 151.—Tetragonolobus was once considered a separate genus, largely because of the 4 leafy wings of the pod. Grown chiefly for food, the pods being eaten when young and the seeds, when roasted, substituted for coffee. Seeds sown in drills in April. Plants require no care except water during drought.

L. Balambénsis, a pink-fld. Abyssinian plant, was int. to American trade by Franceschi, who says it was originally sent out by Dammann & Co., Naples, Italy, and is not worth cult.—*L. Canariénsis floribúndus* is not in Index Kewensis. Franceschi writes that it has yellow fls. and is desirable for rockeries and hanging baskets; that it is not far from L. corniculatus, but has a different habit; and that it was offered many years ago by Wildpret of Orotana and later by Albert Scheubel of Hamburg.

W. M.

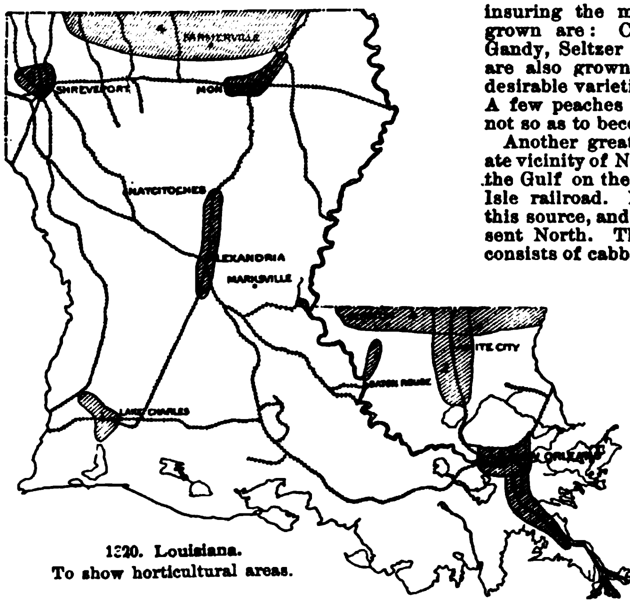
LOUISIANA (Fig. 1320) is situated at the extreme lower limit of the great Mississippi system, bordering on the Gulf of Mexico. These bodies of water have an important bearing upon the climate, and make it possible to grow some of the subtropical fruits. The prevailing wind is from the south, somewhat cool and always laden with moisture, and the southern portion of the state, being only about 30 feet above the sea level, receives the heaviest rainfall, 70 inches, while the northern portion, being more elevated and further from the gulf, has an annual rainfall of 45 to 50 inches. This is, as a rule, well distributed throughout the state, the seasons of greatest drought being early spring and early autumn. The highest recorded summer temperatures run from 98° along the Gulf coast, to 102° in the northern part of the state, while the average winter temperature is 56°. Occasionally a northwestern blizzard reaches down into the state, causing a heavy fall in temperature, accompanied with sleet, and once in a great while, snow. There was a temperature of 9° in 1895, and 13 inches of snow. A minimum of 15° below zero was subsequently recorded in northern Louisiana. These occasional blizzards have forced the culture of tropical fruits down to the section immediately bordering on the Gulf. As the soil has such an important bearing on the character of the fruit, a rough classification of the different kinds is here given.

First: The Sandy Hills and Uplands.—These occupy the northwestern portion of the state, along with a section in the eastern part, south of the state of Mississippi. The lands are characterized by sandy soils, with pine and oak forests, and produce the best apples, stone-fruits and berries.

Second: The Bluff Lands.—These occupy a broken strip, running parallel with the Mississippi, from 30 to

50 miles from its western bank, and disappear near the Gulf in what are known as "islands," such as "Avery's Island" and "Jefferson's Island." There is also another section of these lands on the east bank of the river immediately south of the Mississippi state line. These lands are characterized by a yellow clay loam, very fertile, and by forests of magnolia, gums, oaks, etc. They produce some of the stone-fruits well, and an abundance of pears, berries and figs.

Third: The Prairie Lands.—These occupy a portion in the central southwestern part of the state, are treeless, low and are also known as rice lands. The soil is poor but improves with cultivation, and gradually the planting of figs, pears, peaches, plums and grapes has been extended.



1220. Louisiana.
To show horticultural areas.

Fourth: The Alluvial Lands.—These make up all the other portions of the state not mentioned, including the river bottoms. The soil is generally dark, ranging from black to light red, very fertile and abounding in an abundant growth of timber. They produce the heavy yields of cotton and corn in the northern portion, and the sugar cane, oranges, lemons, persimmons, figs and bananas, as well as other tropical fruits, in the southern part.

The leading varieties of vegetables are grown in every section of the state, and the home garden furnishes an abundant supply during all seasons of the year, under proper management. Those vegetables most popularly grown for home consumption are as follows: Asparagus (on the sandy soils only), artichoke (both Globe and Jerusalem), bean, beet, cabbage, carrot, collard, corn, cress, cucumber, cashaw (pumpkin), endive, eggplant, kohlrabi, leek, lettuce, melon, mustard, okra, onion, parsley, pea, pepper, Irish potato (two crops), sweet potato, radish, spinach, tomato, turnip and rutabaga. Occasionally there is found the vegetable pear (*Sechium edule*), martynia, brussels sprout, celery, chervil, garlic, kale, salsify, parsnip, cauliflower and field pumpkin. The majority of these vegetables may be sown several times during the year. Celery and cauliflower, however, are sown early in August in order to mature by the Christmastide.

The commercial truck sections are found in various sections of the state. Along the Illinois Central railroad a direct line to Chicago from New Orleans, which runs through the warm sandy pine lands, the most extensive truck farms are to be seen. The vegetables grown are radishes, beans, cantaloupes, cucumbers and tomatoes. The town of Roseland alone, in 1898, shipped 50,000 bushels of radishes. Hundreds of car-loads of these vegetables are sent to the Chicago, Cleveland and St. Louis markets during the months of March, April and May. This section also produces enormous quantities of early strawberries, as hundreds of acres are planted each year, and shipments are sent by car-load lots from the stations on this line in Tangipahoa parish. The plants are set in August and September of each year, and, as a rule, are kept but one season. Abundance of pine straw is used for mulch, and when an early spring frost threatens, this mulch is also used to cover the plants as well, oftentimes protecting them so that the first and most valuable fruits escape and mature, thus insuring the most profitable picking. The varieties grown are: Cloud, Michel Early, Miller, Bubach, Gandy, Seltzer and Creole Beauty. The Japan plums are also grown in this section extensively, the most desirable varieties being the Abundance and Burbank. A few peaches and Japan persimmons are grown, but not so as to become a commercial product.

Another great truck section is found in the immediate vicinity of New Orleans, and along the river towards the Gulf on the New Orleans, Fort Jackson and Grand Isle railroad. New Orleans is supplied mainly from this source, and at the same time enormous amounts are sent North. The truck grown for the latter purpose consists of cabbages, onions, tomatoes, beans, peas, eggplants and cantaloupes. Cucumbers are also grown, both in the hotbed and in the open, oftentimes bringing high returns when sent North, the winter prices ranging from 30 cents to $2.50 per dozen.

The lower portion of this section contains also the great orange groves of the state. They are located all along the river, and it is only when a belated blizzard visits this section that a crop failure is experienced. Some of these orchards contain more than 100 acres. The stocks now used are almost entirely the common sour and *Citrus trifoliata*. Occasionally the sweet seedlings and lemons are used, but not to any extent. The first two mentioned are the hardiest stocks known, and mature their wood, making a more desirable tree. The varieties grown are: Satsuma, Boone Early, Sweet Seville, Parson Brown, Brazilian, Baldwin No. 1, Creole, Homosassa, Washington Navel, DuRoi Blood, Hart Tardiff, Rivers Unknown and Schœnberger. Besides these, large quantities of mandarins, tangerines and Kumquat oranges of various varieties are grown. The various scale insects, so serious when no care is given, are, as a rule, kept in complete control by the careful use of insecticides, and the laws governing the importation of infected trees are rigidly enforced. As oranges in Louisiana are grown on such different soil from the orange sections of other states, one or two points must always be kept in view. Beds should be raised before the trees are set, and the crown roots of the young tree should be just at the surface of the ground. These requirements are necessary on the alluvial lands of the lower Mississippi. The Satsuma, Kewochai and Dai Dai are Japanese varieties, and when worked upon *Citrus trifoliata* stock will stand much more cold than the sweeter oranges. The Satsuma thus worked is the most desirable and will stand a temperature of 13° F. without injury. The orange industry is increasing annually, the crop for 1898 being upwards of 300,000 boxes.

Another truck section is found along the Iron Mountain railroad north of Alexandria; it is limited to only a few crops, such as melons, tomatoes and Irish potatoes. Along the Vicksburg, Shreveport and Pacific railroad large quantities of Irish potatoes are grown, while along the Kansas City, Pittsburg and Gulf railroad and the Mississippi Valley railroad, only limited quantities of truck have been sent out. From reliable statistics it is found that the annual output of Louisiana approximates 40,000 tons of fruit and 60,000 tons of vegetables. The varieties of these vegetables grown for the Northern markets are as follows: The Acme and Beauty tomatoes, the Chartier radish, the New Orleans Market eggplant, the Peerless and Triumph Irish potatoes, the New Orleans Market and White Spine cucumbers, the New Orleans Market cantaloupe, the Drumheads, Flat Dutch, Succession, All-Seasons and Nonesuch cabbages, the Italian and Bermuda type of onions, the First and Best and Alaska peas, the Early Mohawk and Valentine beans. In the northern part of the state large quantities of Irish potatoes are grown, and oftentimes the second crop is very profitable. The first crop is planted in January or February and harvested in May and June. The seed for the second crop is prepared for planting by special treatment, consisting of gradually exposing the tubers to the light and moisture, which matures them and excites the eyes into growth. As soon as this is accomplished they are ready for planting, which is usually during August. They are harvested in November.

Upwards of 3,500,000 bushels of sweet potatoes are grown annually, the varieties best known being Pumpkin, Creole, California, Bermuda, Red and Yellow Nansemond, Hayman, Providence, Yellow Jersey, Southern Queen and Vineless. The last variety is one of the most desirable of the newer sweet potatoes.

The culture of fruit, other than oranges and strawberries, has been neglected in great measure. Apples do fairly well in the northern part of the state, the desirable varieties being Smith, Horse, Red June, Magnum, Early Harvest, Cullasago, Shannon, Shockley and Red Astrachan. Grapes are grown but sparingly, as the long, warm, moist season offers the best conditions under which the grape diseases develop, and the frequent rains hinder the use of fungicides; however, in the northern and southwestern portions of the state the following varieties have been found desirable: Champion, Diamond, Eaton, Niagara, Concord, Delaware, Brighton, Sweet Mountain, Herbemont and Jacques. Only the Chinese type of pears is at all grown, as it offers more resistance to the blight than the others. The desirable varieties are Le Conte, Kieffer, Smith, Garber, Dai Dai, Golden Russet and Mme. Von Siebold. The European varieties of plums do not succeed, but many of the American and Japanese sorts do well. The desirable varieties are Burbank, Abundance, Satsuma, Kelsey, Chabot, Wild Goose, Robinson and a few others. The fig is grown universally in all sections of the state, the best varieties being Celeste, Brunswick, White Ischia, Magnolia, Angelique, Lemon, Mission and Reine Blanche. The Japan persimmons are being set extensively, using chiefly the Hyakume, Kurokume, Nero Zami, Hachiya, Tsuru and Among. These fruits are large, showy, and will stand transportation well. The Elberta, Sneed, Peen-to (in the south) and Chinese Cling peaches prevail.

The other fruits, grown in a limited way, are quinces, goumi, blackberries, dewberries, a very few raspberries, pomegranates, bananas, jujubes and pawpaws. There are a few other tropical fruits that are grown only for specimens.

Louisiana abounds in beautiful flowering shrubs and wild flowers. The planting of all kinds of ornamentals is very extensive, roses bloom throughout the season, and the camellia finds a congenial home throughout the southern part of the state. In and around New Orleans the finest ornamental plantings will be found, St. Charles avenue, the principal residence street, being especially beautiful, with its palms, roses, camellias and ornamental vines. This is not confined to the wealthier classes, for nearly all these ornamentals grow readily from cuttings with little care, and even the poorest people oftentimes have the choicest flowers and roses around their doorstep.

F. H. BURNETTE.

LOUSEWORT. *Pedicularis.*

LOVAGE. *Levisticum.*

LOVE APPLE. First popular name of the Tomato, now dying out in America. **Love-in-a-mist.**=*Nigella.* **Love-lies-bleeding.** *Amarantus caudatus.*

LOXOSCÀPHE (Greek, *an oblique boat*). *Polypodiàceæ.* A small genus of southern hemisphere ferns, related to Davallia. Indusium forming a compressed, suborbicular or cup-shaped sac, open only at the top: lvs. with linear segments. For culture, consult *Davallia.*

thecifera, Moore (*Davállia concínna,* Schrad.). Stipes 3–4 in. long: lvs. 6–9 in. long, bipinnate; divisions 2–3 lines long, ½ line wide. S. Amer. and Africa.

fœniculàcea, Moore (*Davállia fœniculàcea,* Hook.). Stipes 6–8 in. long: lvs. 9–18 in. long, quadripinnate; divisions less than ½ line wide. Fiji Islands.

L. M. UNDERWOOD.

LUCERNE. See *Alfalfa* and *Medicago.*

LUCÙLIA (probably adapted from a native name). *Rubiàceæ.* A genus of 2 species of tender shrubs from the Himalayas, bearing in winter terminal corymbs sometimes a foot across, composed of 20–40 pink or white, fragrant, salver-shaped fls. with 5 rounded lobes, each fl. being 1½–2 in. across. A plant of *L. gratissima* is on record which attained 6½ ft., bearing 24 bunches of fls. each 2 ft. in circumference, beside 30 smaller bunches. Calyx tube top-shaped; lobes unequal, deciduous; stamens 5, inserted on the tube of the corolla; filaments very short: disk annular: ovary 2-celled: style 2-branched.

L. gratissima is one of the most beautiful winter-flowering shrubs for house decoration, and deserves to become more popular with florists for Christmas sales. The wood ripened after flowering furnishes the best cuttings. Newly rooted plants require a night temp. of 60° at first, but the temp. should be gradually reduced and the plants hardened off before they are planted outdoors for the summer. Young plants should never be allowed to get dry from the time of first potting until they are taken outdoors. For potting a light soil is desirable. When the pots are well filled with roots, apply liquid manure two or three times a week until the buds appear. During the summer the plants should be syringed daily, as they are subject to red spider. The plants should be lifted, potted and brought indoors the last week of Aug. If left out later they do not set flower buds as well. As soon as the buds appear the plants should be moved to a warmer house, with a night temp. of 55°. After flowering the plants should be trimmed somewhat, given less water, kept in a night temp. of 45° and syringed daily. They start slowly, but make hardy growths for planting out.

gratissima, Sweet. In the wild a tree attaining 16 ft.: lvs. opposite, ovate-oblong, acuminate, acute at the base, 4–6 in. long: panicle decussately branched: fls. pink or rose, forming a gorgeous rounded mass; corolla lobes imbricated in the bud; stamens inserted in the tube, slightly exserted. S.B.F.G. 145. B.M. 3946. G.C. III. 21:81. R.H. 1843:385 and 1890:180. Gn. 35, p. 58; 41, p. 469; 55, pp. 42, 107. A.F. 7:443 and 10:679.

L. Pinceàna, Hook. Lvs. oval: fls. in a compound cyme, the lobes pure white above, changing to a cream, with a rosy tinge, outside rosy and the tube red. Distinguished by the presence of 5 pairs of tubercles at the base of each sinus. B.M. 4132. Gn. 35, p. 59 and 41, p. 469.—*L. speciòsa,* Hort., is not in Index Kewensis. H. A. Siebrecht writes that it is in every way like L. gratissima, except that the fls. are much larger and of a deeper color. He says it is a stronger grower and just as fragrant.

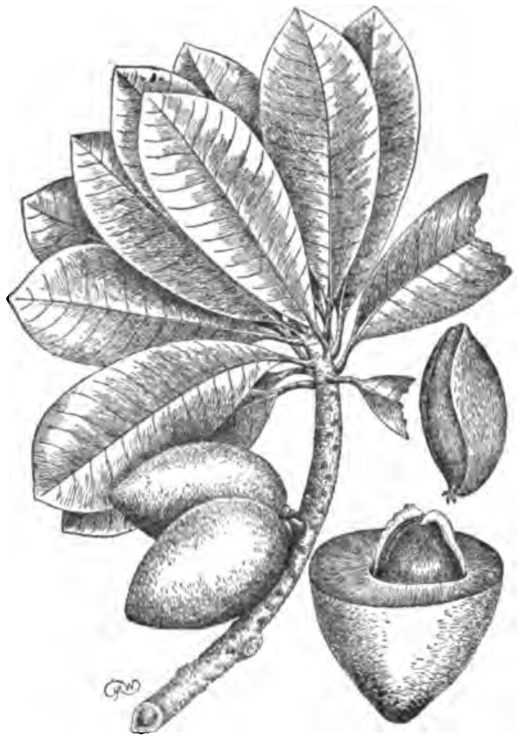
GEO. MCWILLIAM and W. M.

LUCÙMA (Peruvian name). *Sapotàceæ.* About 50 species of trees and shrubs, largely S. American, two of which are tropical fruit trees. *L. Rivicoa* produces the Egg Fruit, or Ti-es, which is about the size and shape of a hen's egg, and tastes like the yolk of an egg sweetened with sugar. As cult. in S. Fla. and S. Calif. it makes a large evergreen bush or small tree. It is related to the Sapodillo, but the floral parts of the latter are in 6's instead of 5's. *L. mammosa* produces the Marmalade Plum (Fig. 1321), which has a rough and rusty skin and russet-colored edible pulp. This fine fruit grows wild in the West Indies and the Philippines.

mammòsa, Gærtn. MARMALADE PLUM. Fig. 1321. Lvs. obovate-oblong or spatulate, chartaceous, 6–8 in. long, 2–3 in. wide, mucronate: calyx segments 9–10, inner ones larger and notched: ovary 5-celled: fr. usually 1-seeded by abortion. S. America, West Indies, Philippines.

Rivicòa, Gærtn. Lvs. elliptic-obovate, obtuse, membranous, 4–8 in. long, 1½–3 in. wide: calyx 5-parted: ovary 5-celled: seed ovoid-globose. Brazil, French Guiana.—Var. **angustifòlia**, Mart., is the EGG FRUIT or TI-ES of the W. Indies. It has elliptic-lanceolate lvs., acute at both ends. Fig. 1322. Cult. in S. Fla. and S. Calif.

W. M.



1321. Lucuma mammosa (× ⅛).

Lucuma mammosa, the "Mammee Sapota" of Jamaica, is the fruit of a tree found wild also in Cuba and the northeastern part of S. America. The tree is ornamental, about 30 feet high, of a pyramidal shape. It is occasionally seen where it was originally planted in pastures near dwelling houses, but except for the droppings from cattle and horses, it receives no other cultivation. It requires a good deep soil and an annual rainfall of about 70 inches. The flowers are cream-colored, about ½ inch long, springing directly from the bark. The fruit is about 6 inches long, with usually only 1 seed. It has a russet-colored rough skin. The flesh is of a dark yellowish red color, soft and sweet; it has been compared to a very ripe pear, but is more luscious. Marmalade is made from the fruit, whence the name of "Marmalade Plum."

WM. FAWCETT.

LUDWÍGIA (C. G. Ludwig, botanist and botanical author at Leipzig, 1709–1773). *Onagràceæ*. About 25 species of aquatic or semi-aquatic small herbs, widely distributed in temperate and warm climates. Fls. small and inconspicuous in the axils of the leaves, the parts usually in 4's. Lvs. mostly small and mostly entire or very nearly so, usually not distinctly petioled. The stems are often creeping, sometimes floating. The opposite-lvd. species are by some referred to the genus Isnardia. The Ludwigias have little standing as horticultural subjects. They are sometimes useful in bog gardens, and one is advertised for aquaria. Three species are in the Amer. trade.

A. *Leaves opposite.*

palústris, Ell. (*Isnárdia palústris*, Linn.). WATER PURSLANE. Trailing in muddy places or floating on shallow water, rooting at the joints: lvs. oval or oval-oblong, narrowed into a short petiole: fls. very small, usually reddish.—Widely distributed in this country; offered as a bog plant.

Mülertii, Mulertt. Lvs. lance-oblong, usually narrowed into short petioles, entire: fls. yellow: fr. oblong, truncate on top, ⅜ in. long.—Int. from S. Amer. by Hugo Mulertt, then of Cincinnati, and described in "Isis" (published in Germany) in 1880 or 1881, and also in the "Aquarium," Vol. III. p. 43, 64. It is now widely distributed amongst growers of aquarium plants. It seems not to have been studied by systematic botanists. It is prized for its graceful habit and because it is evergreen. Grows well from cuttings and from seeds.

AA. *Leaves alternate.*

alternifòlia, Linn. SEED-BOX, or RATTLE-BOX. An erect shrub, 2–3 ft. or more tall, in appearance not unlike an Epilobium: lvs. lanceolate or oblong-lanceolate, narrowed below, entire or sometimes with mere suggestions of teeth: fls. large for the genus (½ in. across), with yellow caducous petals: capsules large, square in cross-section. Bogs in eastern states.—Interesting, but not showy.

L. H. B.

LUEHÈA (F. Karl van der Lüke, Austrian botanist interested in the Cape of Good Hope). *Tiliàceæ*. About 16 species of trees and tall shrubs from the warmer parts of America with usually toothed lvs. and handsome white or rosy fls. borne in a terminal panicle, or sometimes in the axils; sepals and petals 5; stamens numerous, the outer ones often without anthers: ovary 5-celled: capsule rather woody, loculicidally semi-5-valved. An undetermined species is advertised in Santa Barbara, 1900, from Paraguay. Franceschi writes that the inner bark is used generally in Paraguay instead of string. Luehea is also spelled Luhea, and the genus of this name of the Verbenaceæ is a South African genus referred to Stilbe.

LÚFFA (*Luff* is the Arabic name). *Cucurbitàceæ*. RAG GOURD. DISHCLOTH GOURD. VEGETABLE SPONGE. Six species (according to Cogniaux, Vol. 3, DC. Monogr. Phaner.) of annual tendril-climbing herbs, inhabiting the tropics of the Old and New Worlds. Fls. monœcious, the staminate ones in a long-stalked raceme or cluster, the pistillate ones solitary and shorter-peduncled; calyx bell-shape or top-shape, strongly 5-lobed; corolla of 5 soft yellow or whitish petals, sometimes ragged-edged; stamens usually 3, borne in the calyx tube: fr. a long, gourd-like pepo, becoming dry when ripe and the fibrous interior sponge-like. Known south as "California Okra."

Of late years, the Luffas have come into prominence in American gardens, being an importation from the tropics and China and Japan. In other countries, the fruit is eaten when young, being cooked like squash or served in soups and stews. The young fruit is sometimes sliced and dried. (See Georgeson, A.G. Sept., 1892, and Bailey, Bull. 67, Cornell Exp. Sta.) In this country, Luffas are grown mostly for curiosity and ornament. The fibrous interior of the dried fruit, when bleached and prepared, is used as a sponge for the bath and for scrubbing (whence "Vegetable Sponge"). The culture is the same as for cucumbers and melons. They are tender plants, running 10 to 15 ft. The Luffas are widely dispersed in the tropics as cultivated plants. The genus divides itself into 2 groups,—those species (*L. Ægyptiaca* and *L. acutangula*) with fruits not spiny or tuberculate, and those with spiny fruits. Only the following species are known to be in cult. in this country:

Ægyptiaca, Mill. (*L. cylindrica*, Roem. *L. Petòla*, Ser. *L. Veitchii*, Naud. *L. fœtida*, Hort. [at least in part], not Cav. *L. Fabiàna*, *Japónica*, *Mexicàna* [?] and *noctiflòra álba*, Hort.). NAGA ITO-URI of Japanese. SU-KWA of Chinese. The commonest Dishcloth Gourd: stems slender-running, furrowed, roughened: lvs. roundish in outline, mostly 15-lobed, coarsely toothed, very scabrous above and beneath: staminate fls. 2–3 in. across, wilting in the sun: ovary cylindrical or clavate, pubescent, destitute of distinct ridges, ripening into a slender, cylindrical, curved fruit 1–2 ft. long. Probably native to the Old World, but widely distributed in the tropics. A.G. 13:526.

acutángula, Roxbg. (*L. fœtida*, Cav.). SING-KWA of Chinese. Fig. 1323. Lvs. rounded, scarcely lobed, very coarsely toothed: ovary 10-ribbed, ripening into a strongly ribbed fruit. Tropics. Gt. 48, p. 136. L.H.B.

LUÍSIA (after Don Luis de Torres, of whose personality little is known). *Orchidàceæ*. Curious epiphytic herbs, with simple or branched erect stems, bearing alternate, elongated, fleshy-terete lvs.: fls. sessile, on short lateral spikes; sepals and petioles sub-similar, connivent or half-spreading; labellum adnate to the column, somewhat concave, with small lateral lobes and a large, spreading, entire or bifid middle lobe; column short; pollinia 2, on a broad, short pedicel. About 10 species. These plants are rarely cult. They grow well in any warm or intermediate house.

téres, Blume. Spike few-fld.: lateral sepals narrower than dorsal, which is similar to the petals: labellum bi-auriculate, oblong-sulcate, apex bifid.

L. téres, Lindl.=Sarcanthus teretifolius.

HEINRICH HASSELBRING.

LUNÀRIA (*Luna*, Latin for moon; name referring to the silvery white partition of the large pods). *Cruciferæ*. MOONWORT. HONESTY. Two herbs of Europe and W. Asia, both cult. in old gardens. Lvs. rather large, simple, broad or more or less cordate: fls. purple, in terminal racemes or panicles, rather large and showy: fr. stalked in the calyx, becoming a very large, flat, disk-shaped silicle, with deciduous valves and a thin, persistent septum: seeds winged, 2-4 in each compartment. The plants are easy of cultivation under any ordinary garden conditions. They are interesting for their showy fls., but are grown mostly for their great flat pods, which are used in winter bouquets. They are called "Honesty" because the seeds can be seen through the pods. Prop. by seeds; or the second species rarely by division. The species sometimes escape from gardens.

1323. Luffa acutangula (× 1-9).

ánnua, Linn. (*L. biénnis*, Mœnch). Fig. 1324. Loose-hairy plant, 1½-2½ ft. tall, branching as it matures: lvs. somewhat cordate or halberd-cordate, coarsely and irregularly toothed, stalked: fls. numerous, pink-purple, fragrant, in late spring or early summer: pods about 2 in. long and somewhat narrower, very flat, rounded at the ends, tipped with the persistent style. Europe. R. H. 1857, p. 30.—Frequent in old-fashioned gardens. There is a recent form with handsomely variegated lvs.; also a white-flowered form. Annual and biennial.

rediviva, Linn. Differs from the last in being perennial, the fls. smaller and lighter colored (often grayish purple), and the pod elliptic or lance-elliptic, and tapering to either end. Europe.—Less common and less valuable than the other. L. H. B.

LUNGWORT. *Mertensia.*

LUPÌNUS (from the Latin *lupus*, a wolf; because a crop of Lupines was supposed to destroy fertility). *Leguminòsæ*. LUPINE. A group of about 80 species mostly confined to western N. America, a few growing in eastern N. America and in the Mediterranean region. Most are annuals or herbaceous perennials, one species in cult. being shrubby. All are showy plants with conspicuous flowers in terminal racemes, those of the species in cult. being mostly verticillate. The flowers are blue, white or yellow, or a union of these, papilionaceous and free-blooming. All are of easy cult. in any garden soil, except that they are said not to succeed in soil containing lime. They are adapted to borders in masses, and to all places in which low-growing showy herbs would be found. Some make good bedding plants, others cut-flowers. They are propagated by seed, the perennials also by division. They do not bear transplanting when once established, hence it is recommended to sow seed where the plants are finally desired. A few species are of value economically for soiling or plowing under. Leaves usually digitate, with 5-15 entire leaflets: flowers with calyx deeply bilabiate, 5-toothed, unequal; corolla with simple erect, broadly ovate standard, having strongly reflexed sides; wings united at the apex and enclosing the keel; stamens

1322. Lucuma Rivicoa, var. angustifolia (× ½).

united into a closed tube: pod 2-valved, flattened, enclosing several large seeds. A very variable genus in the garden.

There are numerous garden hybrids of unknown parentage. Some of these names will be found in the supplementary list. Voss groups these under the name of *L. hybridus*, Hort., or Florists' Lupines. They have variegated flowers.

In addition to those described below the following native species have been advertised, mostly by Gillett, in 1881, for western collections. Probably they are not in cult. They are mostly described in Bot. Calif.: *L. albicaulis, Chamissonis, densiflorus, lepidus, leucophyllus, ornatus* and *villosus*.

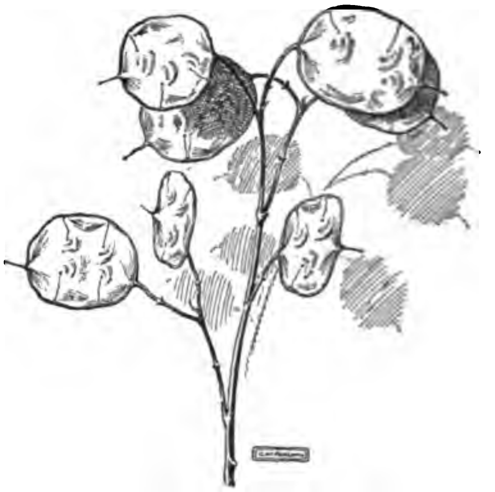
INDEX.

affinis, 13.
albo-coccineus, 20.
albiflorus, 6.
albus, 14, 15, 20.
arboreus, 1.
argenteus, 5.
bicolor, 6.
Cruckshankaii, 18.
diffusus, 2.
foliis roseis, 14.
grandiflorus, 6.
Hartwegii, 17.
hirsutus, 14.
luteus, 1, 10.
micranthus, 12.
mutabilis, 18.
nanus, 20.
Nootkatensis, 7.
parviflorus, 4.
perennis, 3.
pilosus, 11.
Plattensis, 8.
polyphyllus, 6.
pusillus, 16.
ruber, 14.
Snow Queen, 1.
subcarnosus, 19.
sulphureus, 9.

A. *Perennials.*
B. *Plants shrubby*.................. 1. **arboreus**
BB. *Plants herbaceous.*
C. *Lvs. with 1 leaflet*............. 2. **diffusus**
CC. *Lvs. with several lfts., digitate.*
D. *Foliage not conspicuously hairy above.*
E. *No. of lfts. 5–9.*
F. *Lfts. shorter than petioles.*
G. *Pod ½ in. long*... 3. **perennis**
GG. *Pod ¾ in. long*... 4. **parviflorus**
FF. *Lfts. as long as petioles* .... 5. **argenteus**
EE. *No. of lfts. 10–16*......... 6. **polyphyllus**
DD. *Foliage conspicuously hairy or silky above.*
E. *Fls. parti-colored, striped* .... 7. **Nootkatensis**
EE. *Fls. light blue, with a dark spot on the standard* .... 8. **Plattensis**
AA. *Annuals.*
B. *Fls. yellow.*
C. *No. of lfts. 13–15* .... 9. **sulphureus**
CC. *No. of lfts. 7–10* ....10. **luteus**
BB. *Fls. blue, white or red, but self-colored.*
C. *Arrangement of fls. in whorls.*
D. *No. of lfts. 9–11* ....11. **pilosus**
DD. *No. of lfts. 5–7.*
E. *Plant villous*...........12. **micranthus**
EE. *Plant merely puberulent*.13. **affinis**
CC. *Arrangement of fls. scattered.*
D. *Lfts. hairy on both sides* ...14. **hirsutus**
DD. *Lfts. not hairy above.*
E. *Color of fls. white*.......15. **albus**
EE. *Color of fls. blue*........16. **pusillus**
BBB. *Fls. of 2 or more colors.*
C. *Foliage hairy on both sides* ...17. **Hartwegii**
CC. *Foliage not conspicuously hairy above.*
D. *Height about 5 ft*...........18. **mutabilis**
DD. *Height 1 ft. or less.*
E. *Arrangement of fls. alternate* ......,...........19. **subcarnosus**
EE. *Arrangement of fls. whorled* ....20. **nanus**

1. **arbòreus**, Sims. TREE LUPINE. Lfts. 7–11, lanceolate-linear, acute, silvery downy below, entire: fls. somewhat verticillate, in tall, loose racemes, sulfur-yellow, fragrant: pods pubescent, 1½–3 in. long. July–Sept. Common in Calif. B.M. 682. Gn. 30, p. 289 and 47:1017. —Shrub, 4–10 ft. high, somewhat pubescent, not hardy at the north. Var. **Snow Queen** or **Queen of the Snow** is pure white. Var. **lùteus** has been advertised.

2. **diffùsus**, Nutt. DEER CABBAGE. Stem decumbent and many-branched, 1–2 ft., somewhat woody at the base, densely silky: lvs. large, oval or oblong-ovate, obtuse, mucronate, on long, soft-silky petioles: fls. more or less alternate, on a very long (6–12 in.) spike, light blue, the standard with a greenish yellow center: pods oblong, flattish, very woolly. April. Sandy barrens, N. Car. to Fla.—Hardiness North not determined.



1324. Lunaria annua (X ½). (See p. 949.)

3. **perénnis**, Linn. SUN-DIAL. COMMON WILD LUPINE. Stem erect, 1–2 ft. high, rather stout, minutely pubescent: lvs. long-petioled, soft-downy; lfts. 7–9, obovate-oblong to lanceolate, obtuse, glabrous above, soft-downy below: fls. in large, loose terminal spikes or racemes, alternate, blue, varying to white. June, July. Canada to Fla. B.M. 202. Mn. 6:101. B.B. 2:269.—Desirable species, growing in the poorest soil, preferring sandy land. Grows from subterranean rootstocks.

4. **parviflòrus**, Nutt. Fig. 1325. Fls. light blue, smaller than in *L. perennis*. Columbia river to Yosemite and Wahsatch.—Fig. 1325 is from a photograph by D. M. Andrews.

5. **argénteus**, Pursh. Fls. blue or cream-colored. Western N. Amer. B.B. 2:269.

6. **polyphýllus**, Lindl. (*L. grandiflòrus*, Lindl.). Stout, erect species, forming tufts 2–5 ft. high: lvs. distant, mostly radical, long-petioled; lfts. lanceolate, glabrate above, silky hairy below, 2–6 in. long: fls. on long stalks, alternate, pedicelled, deep blue: pod 1–1½ in. long, narrow. June–Sept. Washington to Calif. S. B.F.G. II. 356. Gn. 45, p. 459 and 55:215.—A common garden species of merit, succeeding in any good soil. Var. **albiflòrus**, Hort. (var. *álbus*), is white, bold and showy. Var. **bicolor**, Hort., is variegated blue and white.

7. **Nootkaténsis**, Don. Stem hairy, decumbent, with long, spreading hairs, 2–3 ft. high: lfts. 5–9, narrowly obovate-oblong, smooth above, hairy below, mucronate; stipules lanceolate, nearly as long as the lfts.: fls. in dense racemes, blue, variegated with red and yellow, with large veins, variable. May–July. Nootka Sound. B.M. 1311 and 2136.—Coarse, stocky species, said to be unsuitable for small gardens, but of merit.

8. **Platténsis**, S. Wats. June, July. Neb., Wyo., Dak. B.B. 2:269.

9. **sulphùreus**, Dougl. Stem very erect, white silky: lfts. narrowly lanceolate, densely hairy on both sides, shorter than the petiole: fls. in tall, dense racemes, sulfur-yellow: pods woolly, 1 in. long. July, Aug. Mts. of Oregon. R.H. 1890, p. 252.—Strong species branching above, bare below.

10. **lùteus**, Linn. YELLOW LUPINE. Fig. 1326. Stem erect, nearly simple, hairy, 2 ft. high: lfts. lanceolate, acute, hairy: fls. on pubescent stalks longer than the

lvs., verticillate, yellow, fragrant: pod oblong, flat. June, July. S. Eu. B.M. 140.—Succeeds in the poorest soil. Useful for cut-flowers, for the border, for fodder or for plowing under to improve sandy soils. As a fodder, it may be fed green or as hay.

11. **pilòsus**, Linn. Stem hairy, 2–4 ft. high: lfts. oblong-lanceolate, hairy: fls. verticillate, pedicelled, rose, the middle of the standard red. S. Eu.

12. **micránthus**, Dougl. Stem slender, 3–12 in. high, hairy: lfts. linear, ¼–1 in. long: fls. in short, dense racemes, somewhat verticillate, very small, violet, standard and wings narrow: pod linear. Gravelly places, Ore. to Calif.—A slender plant of branching habit.

13. **affinis**, Agardh. Stem rather stout, 8–10 in., pubescence very short: lfts. broadly wedge-obovate, obtuse, long, more or less smooth above; stipules one-half the length of lvs.; petioles twice longer than the lfts.: fls. on a long stalk, deep blue: pod linear. Early spring. Calif.—A free, hardy species, often growing very rank.

14. **hirsùtus**, Linn. BLUE LUPINE. Stem hairy, 2–3 ft. high, branching toward the top: lfts. 7–9, oblong or oblong-oval, hairy, long-petioled: fls. somewhat verticillate or scattered, large, mostly purple, sometimes variegated with blue or violet: pod large, very hairy. July, Aug. S. Eu.—Used ornamentally and as an economic plant for the same purposes as *L. luteus*. It is valuable for fodder and for plowing under. Var. **albus**, Hort., has white fls. Var. **rùber**, Hort., and var. **fòliis ròseis** are advertised.

15. **álbus**, Linn. WHITE LUPINE. Erect stem, 1½ ft. high: lfts. obovate-oblong, 5–7, hairy below, 1½–2 in. long: fls. alternate stalked, on erect stems, quite large, white: pods large. Summer. Asia and S. Eu.—A good fodder plant said to be of greater thrift than *L. luteus*, and remaining green longer. Succeeds well on the poorest soil and is valuable for plowing under. Seeds are sown April–July, the plants plowed under when in flower.

16. **pusíllus**, Pursh. Lfts. about 7, mainly oblong, acute: fls. blue or purple. Prairies. B.B. 2:270.

17. **Hártwegii**, Lindl. Stem erect, 2–3 ft. high, somewhat branching: lfts. 7–9, oblong, obtuse, very hairy: fls. in many-fld. elongated racemes, blue; standard whitish, then reddish. June–Sept. Mexico. B.R. 25:31.—Var. **álbus** is also sold. Possibly a perennial but cult. as an annual.

1325. Lupinus parviflorus.

18. **mutábilis**, Sweet. Stem erect, branched, somewhat woody, 5 ft. tall: lfts. 7–9, lanceolate, obtuse, hairy below and somewhat glaucous: fls. large, somewhat verticillate, fragrant; standard white mixed with blue, becoming blue with a large yellow mark in the center; wings and keel white. June–Aug. Mts. of S. America. S.B.F.G. 130. B.M. 2682.—Attractive species, erect and branching but half-hardy.

Var. **Cruckshanksii**, Hook. (*L. Cruckshanksii*, A. Gray). Fls. large, fragrant, white, the standard yellow-rose, becoming violet. B.M. 3056.

19. **subcarnòsus**, Hook. Stem 8–10 in. high, ascending, silky pubescent: lfts. 5–7, obovate-lanceolate obtuse, somewhat fleshy, smooth above, silky below and on margins: fls. in pyramidal racemes, alternate; standard orbicular, deep blue with a white spot in the center divided by a longitudinal fold: pod linear-oblong, silky. Spring. Texas. B.M. 3467.—Spreading species of merit.

1326. Lupinus luteus.

20. **nànus**, Dougl. Stem slender, ½–1 ft., often branching from the base, hairy: lfts. 5–7, linear to oblanceolate pointed, pubescent both sides, stalks 1–3 times longer: fls. in elongated, loose racemes, verticillate on slender stalks, large, white, pointed with clear blue, edged with deeper blue; wings bluish, hiding white-brownish keel: pod hairy. June, July. Calif. S.B.F.G. II. 257. B. R. 20:1705.—This species and its varieties are very floriferous, giving a fine effect in masses and in the border. Var. **álbus**, Hort., white, tinged with lilac. Var. **albo-coccineus**, Hort. A very compact variety, the lower half of the spike rosy red, the upper white; forms compact tufts and is called a superior variety.

L. angustifòlius, Linn., with blue fls., is much grown in Eu. as a fodder plant and for plowing under: annual. Native to the Mediterranean region.

The following are garden hybrids of unknown origin. They mostly have variegated fls. and are common in cult.: *L. atroviolàceus*. Perennial, 2 ft. high. Fls. dark violet, striped with white and yellow.—*L. cœléstinus*. Annual, 2 ft. high. Fls. light blue.—*L. Dúnnetti*. Fls. lilac-purple, gold and white. According to Voss, this is the same as the kinds known to the trade as superbus, insignis (Vilmorin, not Dippe), tricolor elegans, and superbus Dunnetti. There is also a double form.—*L. hybridus*. Probably mixed kinds.—*L. pubéscens*, Benth. Perennial or subshrubby, the pubescence short spreading hardly silky in the new parts: lfts. 7–9, oblong-lanceolate, acute, shorter than the petiole, pubescent on both sides: fls. loosely arranged almost in whorls; pedicels shorter than the calyx: pod hirsute, 4–6-seeded. The above is from the original description. Bentham neglects to state the color of the fls., but an allied species has blue fls. Mottet must be in error in calling this an annual. Mex., Central Amer., Colombia.—*L. tricolor*. See L. Dunnetti.

A. PHELPS WYMAN.

LYCÁSTE (fanciful name). *Orchidàceæ*. This genus contains about 30 species, all natives of S. Amer., Mexico and the West Indies. The flowers are freely produced and remain in good condition on the plant for several weeks. They are normally borne singly on erect or sub-erect bracted scapes, but sometimes twin-flowered stalks occur. Pseudobulbs ovate or oblong-ovate, bearing 1–several plicate leaves at the summit, and sheathing leaves from the base: sepals sub-similar, spreading, the lateral pair united with the base of the column and forming a spur-like chin or mentum; petals smaller, projecting forward, with the tips often recurved; labellum 3-lobed, the lateral lobes erect, middle lobe ascending or recurved, with a fleshy, tongue-like callus on the disk: pollinia 4. In Lycaste the scape arises from the very young leafy axis, which does not develop until several months later. The scape, therefore, appears from the base of the bulb. Among the species, *L. Skinneri* is a favorite orchid with growers. The species of Lycaste are very distinct from each other and do not fall readily into natural groups. This was probably the cause of Reichenbach's complaint that "it is nearly as satisfactory to study this group as it is to brush hedgehogs." The arrangement in the key is purely artificial, and does not indicate close relationship among the species grouped together.

HEINRICH HASSELBRING.

The genus Lycaste is closely allied to Maxillaria and has a similar geographical range, being found from Mexico and the West Indies to Peru and southeastern Brazil. Notwithstanding this wide distribution, however, they readily subject themselves to one general mode of treatment, and may be grown in a bright, cool portion of the Cattleya or warm end of the Odontoglossum department, where they should receive plenty of indirect solar light, moisture and sufficient ventilation to ensure an active atmosphere.

During winter, the night temperature should range from 50° to 55° Fahr., and that of the day 60° to 65°, or a few degrees higher, with sun heat and ventilation. In summer, the air should be as cool as possible, and contain plenty of moisture.

When Lycastes are growing they need a good supply of water at the roots, and should never be allowed to remain dry for a long time, even when at rest. Light syringing overhead is beneficial at all times in bright weather when air can be admitted. The deciduous species, however, must be carefully watered when at rest, for it must be remembered that in casting their foliage they lose most of their active radiating surface, thus reducing evaporation to a minimum.

For special treatment, they may be divided into three groups, *L. aromatica*, *L. costata* and *L. Harrisonæ* forming good types. The *L. aromatica* section embraces besides the type *L. candida*, *L. cruenta*, *L. Deppii*, *L. lasioglossum*, *L. macrobulbon* and kindred sorts, all more or less deciduous. These grow best in pots in a mixture of equal parts chopped peat fiber and sphagnum moss, with a small quantity of leaf-mold added. About one-third of the pot space should be devoted to drainage of broken charcoal or potsherds, and the compost must be carefully and rather firmly pressed in about the roots, leaving the base of the pseudobulbs on a level with or a little below the rim of the pot. The best time for transplanting is just after the plants start into new growth, at which time give a more abundant supply of water.

The *L. costata* group includes, besides the type, such species as *L. lanipes*, *L. locusta* and *L. Skinneri*, which, excepting the last, are but semi-deciduous, large-growing species. They succeed best under pot culture, and should be grown in a compost of about equal parts chopped sod, from which some of the fine soil has been removed, and decomposed leaves, adding a little chopped live sphagnum to keep the soil porous and to retain moisture. The compost should become nearly dry occasionally to prevent it from becoming sour.

The *L. Harrisonæ* section is small; the type and *L. tetragona* are good examples; all are sempervirent and grow best under basket culture in porous material consisting of chopped peat-fiber and live sphagnum, well mixed and interspersed with nodules of charcoal. The compost should be pressed in moderately firm about the roots to keep the plant steady, and newly imported pieces should be held in place by copper or brass wire crossed between the pseudobulbs.

Lycaste stock is usually supplied by new importations, but plants may be increased by cutting through the rhizome between the pseudobulbs, two at least being left to each piece.

ROBERT M. GREY.

INDEX.

alba, 10, 14, 16.
albo-sanguinea, 10.
aromatica, 13, 14.
Barringtoniæ, 8.
Bifrenaria, 16, 17.
candida, 7, 10.
Colax jugosus, 1.
citrina, 16.
costata, 8.
cruenta, 13.
delicatissima, 10.
Deppii, 15.
eburnea, 16.
gigantea, 3.
grandiflora, 10.
Harrisoniæ, 16.
inodora, 17.
jugosa, 1.
lanipes, 5.
lasioglossa, 2.
Lawrenceana, 7.
locusta, 6.
macrobulbon, 9.
Maxillaria, 9, 10, 12, 13, 15, 16.
Measuresiana, 11.
plana, 11.
punctatissima, 15.
purpurata, 10.
rosea, 10.
rubra, 7.
Schilleriana, 4.
Skinneri, 10.
superba, 10.
tetragona, 12.

L. cristata=Paphinia cristata.—*L. Harrisiana* is probably an error for L. Harrisoniæ.

A. *Scape originating in the axil of a leaf above the new leafy axis: labellum with transverse furrows.* (*Colax.*). 1. **jugosa**

AA. *Scape originating in the axil of a leaf below the young leafy axis: labellum usually with longitudinal crests or callosities.*

  B. *Pollinia seated on a common stipe.*

    C. *Scape erect or suberect, normally 1-fld.* (*Lycaste.*)

      D. *Middle lobe of the labellum semi-oblong, rounded, etc., usually obtuse or truncate.*

        E. *Pilose, with long hairs* .. 2. **lasioglossa**

        EE. *Smooth or pubescent.*

          F. *Sepals oblong-lanceolate, spreading* ..... 3. **gigantea**
          4. **Schilleriana**
          5. **lanipes**
          6. **locusta**
          7. **candida**
          8. **costata**
          9. **macrobulbon**

          FF. *Sepals oblong-ovate, spreading or half-spreading* .... 10. **Skinneri**
          11. **plana**
          12. **tetragona**
          13. **cruenta**

      DD. *Middle lobe of the labellum spatulate* .... 14. **aromatica**

      DDD. *Middle lobe ovate-acuminate* .... 15. **Deppii**

    CC. *Scape pendulous, normally several-fld. See Paphinia.*

  BB. *Pollinia seated on 2 distinct stipes.* (*Bifrenaria.*) .... 16. **Harrisoniæ**
  17. **inodora**

1. **jugòsa**, Nichols. (*Còlax jugòsus*, Lindl.). Pseudobulbs 2–3 in. long, with lanceolate-acuminate lvs. 6–9 in. in length, springing both from the apex and base: scape clothed with large bracts, and bearing 2–3 fls., which are subglobose when fully expanded: sepals broadly oblong, obtuse, cream-colored to waxy white; petals ovate-oblong, obtuse, marked with black-purple, transverse bands; labellum smaller, velvety and covered with fleshy ridges: side lobes longitudinally streaked, and middle lobe streaked and splashed with dark purple. Jan.–May. Brazil. B. M. 5661. Gn. 16, p. 77 and 49, p. 294.—Fls. persistent for many weeks.

2. **lasioglóssa**, Reichb. f. Pseudobulbs 3 in. long, ovoid, compressed: lvs. 8–12 in. long, elliptic-lanceolate: scape 1-fld.: fls. 5 in. across; sepals spreading, narrowly oblong, dull brown or greenish brown; petals one-third as long, erect, concave, obtuse, golden yellow; labellum as long as the petals, also golden yellow: lateral lobes short, obtuse; middle lobe oblong, covered with long, soft hairs; callus ovate, notched. Autumn and winter. Guatemala. B.M. 6251.—Very odd but not showy.

3. **gigantèa**, Lindl. Pseudobulbs often 6 in. high, bearing 2–3 oblong-lanceolate lvs. 1½–2 ft. long: scape 1-fld., somewhat shorter than the lvs.: sepals ovate to lanceolate, 3 in. long, rather olive-green; petals somewhat smaller, lanceolate, spreading, of the same color; labellum oblong-lanceolate: side lobes acute; middle lobe ovate, acuminate, serrate, rich maroon bordered with a narrow orange margin; crest fleshy, emarginate. The fl.-stems are said to attain a height of 2 ft., with a single large flower. In most of the specimens in cult. the lip is abruptly rounded off. June–Aug.; Nov., Dec. Widely dispersed in Cent. Amer. B.M. 5616. B.R. 31:34.

4. **Schilleriàna**, Reichb. f. Plant resembling *L. Skinneri* in habit: pseudobulbs 2-lvd.: lvs. elongate-lanceolate, up to 2 ft. long: scape 1-fld., suberect, 8 in. long: sepals large, spreading, oblong-lanceolate, 4 in. long, brown: petals erect, with recurved tips, small, 1½ in. long, white, speckled with brown on the back; labellum as long as the petals, white, speckled and tinged with rose: side lobes small; middle lobe ovate-quadrate,

crenulate; callus tongue-shaped, concave. Often the parts of the flower are more or less spotted and hairy in places. July, Aug. Colombia. Gt. 1321.

5. **lánipes**, Lindl. Pseudobulbs large: lvs. lanceolate, 12–18 in. long: fls. solitary, as many as 15 on a plant, creamy white; sepals and petals oblong-lanceolate; labellum smooth: lateral lobes ovate-obtuse; middle lobe oblong, obtuse, serrate, with a concave, ribbed callus. Oct. Ecuador.—Lindley says the fls. are pale green, 2½ in. long before they expand, without a trace of any other color.

6. **locústa**, Reichb. f. Pseudobulbs pyriform: lvs. oblong-ligulate, acute: fls. smaller than those of *L. Deppii*, all green except the white column; the odd sepal oblong, obtuse; the lateral ones linear-oblong, acute; petals bent down inside of the lateral sepal; labellum with acute side lobes and a semi-oblong, fleshy, convex middle lobe, all green; on the disk are 2 narrow keels, confluent behind into a fleshy emarginate callus. Peru.

7. **cándida**, Lindl. Pseudobulbs ovoid, much compressed: lvs. oblong-acuminate: fls. about 2 in. across; sepals spreading, reflexed and acute at the apices, oblong, slightly woolly at base, yellowish green, sometimes dotted with light rose; petals whitish, revolute, obtuse; labellum white, with a few rose-colored spots: disk plate obtuse emarginate at the apex; column hairy on the inner surface. Costa Rica.—Var. **Lawrenceàna**, Hort. Sepals and petals tinted with rose, otherwise the fls. are like those of the type. Var. **rùbra** has been offered.

8. **costàta.** Pseudobulbs oblong, compressed, 3–5 in. long: lvs. 2–3 at the apex, 6–10 in. long, broadly oblong-lanceolate, acuminate: scape erect, as long as the pseudobulb: fls. large, nearly white or creamy yellow; dorsal sepals oblong-lanceolate, the lateral sepal similar but falcate, united with the column to form a blunt spur; petals smaller, somewhat undulate; lateral lobes of the labellum small, erect; middle lobe ovate-rotund, toothed. Peru. B.M. 5706 (as *L. Barringtoniæ*, var. *grandiflora*).

9. **macrobúlbon**, Lindl. Pseudobulbs very large, ovate, compressed, with several large, oblong, acute lvs.: scapes usually 2 from each pseudobulb, much shorter than the lvs.: fls. large, yellow; sepals ovate-oblong, spreading; petals shorter, somewhat concave, with recurved tips; labellum oblong, as long as the petals, spotted on the disk with brown. Colombia. B.M. 4228 (as *Maxillaria macrobulbon*).

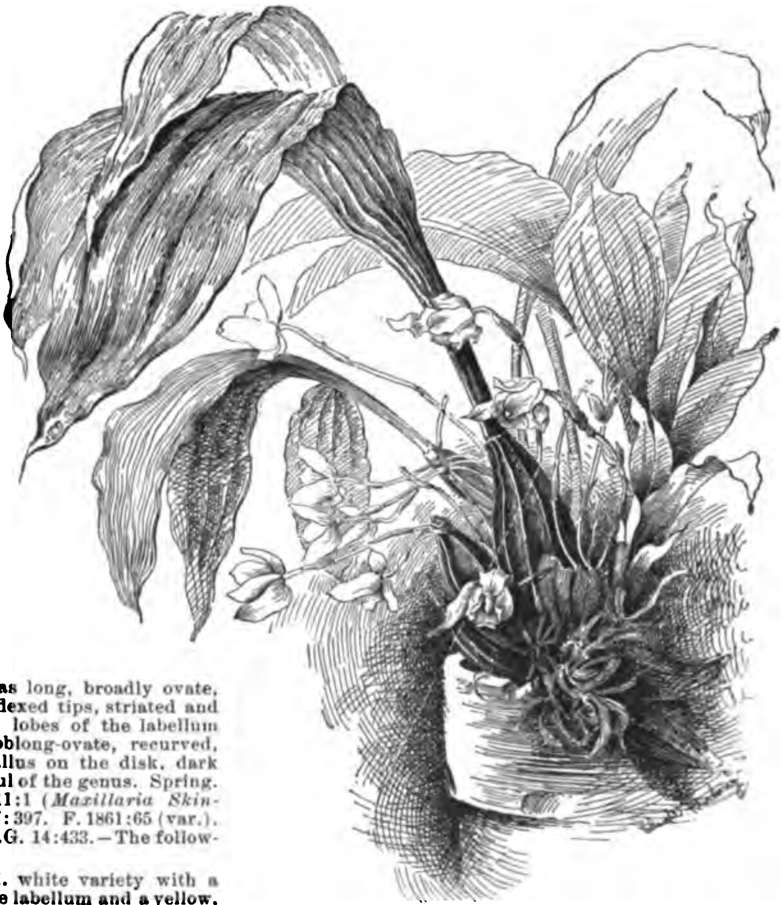
10. **Skinneri**, Lindl. Pseudobulbs oblong-ovate, 3–5 in. high, 1–2-lvd.: lvs. oblong-lanceolate, 9–12 in. long: scapes 5–6 in. long, each bearing a single waxy flower 5–6 in. in diam.: sepals ovate-oblong, white tinged with rose; petals half as long, broadly ovate, pointing forward with acute, reflexed tips, striated and tinged with dark rose: lateral lobes of the labellum erect truncate; middle lobe oblong-ovate, recurved, with a fleshy tongue-shaped callus on the disk, dark crimson-purple. The most useful of the genus. Spring. Guatemala. B.M. 4445. P.M. 11:1 (*Maxillaria Skinneri*). Gn. 25:440; 30, p. 374; 37:397. F. 1861:65 (var.). A.F. 4:519. J.H. III. 34:367. A.G. 14:433.—The following varieties are advertised:

Var. **álba**, Hort. A large-fld. white variety with a tinge of yellow at the base of the labellum and a yellow, tongue-shaped appendage in its throat. I.H. 27:405. Gn. 25:440. F.M. 1872:35. G.C. III. 7:424. A.F. 6:631 Var. **albo-sanguinea.** No description. Var. **cándida** Hort. White. Var. **delicatissima**, Hort. Fls. large, rose white; labellum white blotched with rose. Feb. Var. **grandiflòra.** No description. Var. **purpuràta**, Hort. Sepals and petals rose-white; labellum crimson-purple. Var. **ròsea**, Hort. A beautiful variety with deep rose fls. and a white labellum spotted with crimson. Var. **supérba.** Sepals and petals white; labellum crimson.

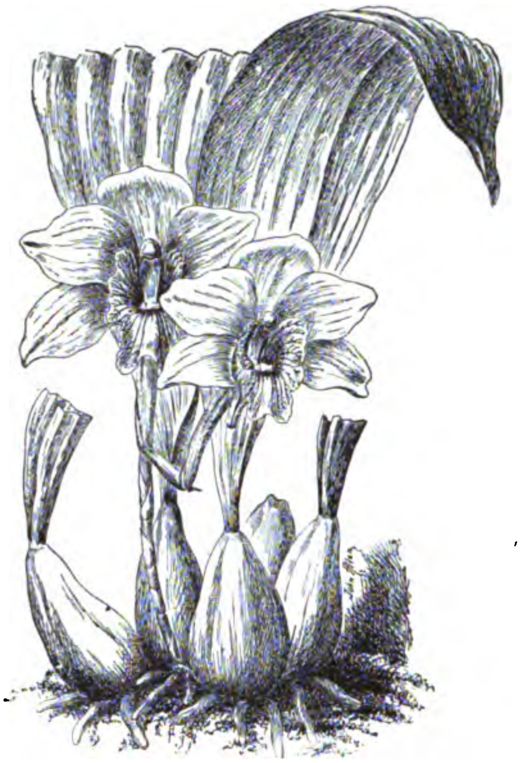
11. **plàna**, Lindl. A robust plant, with large ribbed pseudobulbs and ample-pointed oval lvs.: fls. 3–4 in. across; sepals oblong, plane, rich madder-red inside; petals smaller, with recurved tips, white, tipped with crimson; labellum smaller, white spotted with crimson; side lobes crenulate; middle lobe rounded, obtuse, serrate, crested. Winter. Bolivia. B.R. 29:35.—Var. **Measuresiàna**, Williams. Sepals reddish brown, tipped with green; petals and labellum white spotted with bright rose, except on the margins of the petals. Autumn.

12. **tetrágona**, Lindl. Pseudobulbs ovate, tetragonal: lvs. solitary, ovate-lanceolate: scape 1–4-fld.: fls. greenish streaked with crimson; sepals and petals oblong-ovate, rather obtuse, half-spreading, the 2 lower forming a blunt, projecting angle at base; labellum smaller, white and purple or green and purple, with a shovel-shaped appendage on the disk. Fls. not beautiful, but very fragrant, remaining fresh for two months. June. Brazil. B.M. 3146 and B.R. 17:1428 (both as *Maxillaria tetragona*).

13. **cruénta**, Lindl. Pseudobulbs compressed: lvs. many, oblong, membranaceous: scape bearing 1 yellow flower (rarely 2), much larger than those of *L. aromatica:*



1327. Lycaste aromatica (× 1-5).



1328. Lycaste Harrisoniæ, var. eburnea (× ½).

sepals ovate, obtuse; petals similar, erect and smaller; labellum half as long as the sepals; lateral lobes rounded; middle lobe rounded-truncate, crisp on the margin, pubescent; crest small, fleshy. Like *L. aromatica*, but the lvs. much broader, fls. larger, and the labellum of different shape and somewhat spotted with purple. Mar., Apr. Guatemala. B.R. 28:13 (*Maxillaria cruenta*). Gn. 44:933 (*Lycaste aromatica*).

14. **aromática,** Lindl. Fig. 1327. Pseudobulbs ovate, compressed: lvs. many, sheathing, oblong-lanceolate: scape erect, 1-fld., shorter than the lvs.: fls. yellow, 2½ in. across; sepals and petals ovate-oblong, acute; the latter smaller and pointing forward; lateral lobes of the labellum with narrow, projecting blades; middle lobe spatulate, dentate, recurved, and having a large truncate plate as a crest. Winter and spring. Mexico. B.R. 22:1871.—Floriferous.

15. **Déppii,** Lindl. Pseudobulbs ovate, clustered: lvs. 3–4, broadly elliptic-lanceolate, 1½–2 ft. long: scape erect, bearing 1 or 2 fls. 4 in. in diameter: sepals oblong-lanceolate, dingy green, spotted with chocolate-purple; petals smaller and cuculate, white; labellum bright yellow, with a few purple spots; lateral lobes small, rounded; middle lobe ovate-acuminate, recurved, waved, with a yellow callus. Vigorous and free-flowering. Aug. to May and June. B.M. 3395. L.B.C. 17:1612 (both as *Maxillaria Deppii*). P.M. 2:268 (*Maxillaria Deppei*).—Named after Deppe, but originally spelled Deppii. Var. **punctatissima,** Hort. Fls. much spotted with dark purple. Guatemala.

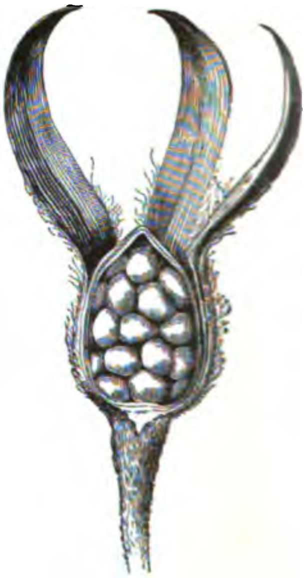
16. **Harrisòniæ,** G. Don. Some authors prefer to call this *Bifrenària Harrisòniæ*, Reichb. f. Pseudobulbs 3–4 in. high, 4-angled: lvs. solitary, lanceolate: scape erect, 1–2-fld.: fls. 2–3 in., cream-colored; sepals spreading, oval, the 2 lower forming a kind of open spur at their united bases; petals oval, spreading; lateral lobes of lip rounded, crenate; middle lobe rounded-emarginate, crenate; all beautiful purple; inside tawny, with purple lines, and an orange callus. Spring. The fls. last a long time. Brazil. B.R. 11:897. B.M. 2927. P.M. 2:196 (all as *Maxillaria Harrisoniæ*). Var. **álba,** Kränzlin. Sepals white, tinged with pink; petals pure white: labellum yellow, with purple veins; front of middle lobe white, with rose veins. Aromatic. Fls. last about three weeks. Gt. 38:1312. G.C. II:25:437. Var. **ebúrnea,** Hort. Fig. 1328. Sepals and petals white; labellum white, richly streaked with carmine; throat yellow. April, May. Brazil. A.G. 12:407. Var. **citrina,** Hort. (*L. citrina*, Lindl.). Fls. large, fleshy; sepals and petals lemon-yellow; lip white, stained with lilac. Brazil.

17. **inodòra,** Lindl. (*Bifrenària inodòra*, Lindl.). Pseudobulbs usually ovate-oblong, 4-angled, 3 in. high: lvs. solitary, short-stalked, oblong-lanceolate, 1 ft. long and 4 in. wide: scape half as long as the pseudobulb, bearing 1–2 large, spreading, brownish green fls. with red hairy lips: sepals roundish oblong, tinged with red, the lateral ones ending in a spur-like projection at base; petals ovate-acuminate, all recurved at the tip: middle lobe of the labellum roundish oblong, undulate, having an elevated process at the center. Resembles *L. tetragona*, but its fls. are not fragrant. Spring.

Since these descriptions were put in type, we learn that Lager & Hurrell have in stock *Lycaste fulvéscens*, Hook. Following is a description from the "Orchid Grower's Manual" (see also B.M. 4193): "Pseudobulbs large, broadly ovate, somewhat membraneous plicate lanceolate leaves two or more from their top, and handsome, tawny yellow flowers, on slender radical scapes. The flowers have lanceolate sepals 2½ in. long, the lateral ones falcate, connate at the base into a blunt spur; the petals are similar, but slightly smaller; and the orange-colored lip is oblong, 3-lobed, with an emarginate appendage on the disk, and an ovate-obtuse front lobe, beautifully fringed at the margin with wavy hairs. Colombia."

HEINRICH HASSELBRING.

LÝCHNIS (from the Greek word for *lamp*, in allusion to the flame-colored fls. of some species). *Caryophyllàceæ*. As commonly understood, Lychnis includes 30 to 40 small herbs of the temperate parts of the northern hemisphere. The technical generic characters are so variable and unimportant, however, as to allow the genus to be thrown into Silene or to be broken up into 7 or 8 distinct genera (for the latter, see Williams, Journ. Bot. 31:167), according to the point of view of the particular author. They are annuals, biennials or perennials, of easiest culture in ordinary garden soil. They are plants which like the sun. They are mostly erect-growing, and the leaves are opposite and entire. The capsule usually has but one locule or compartment, and the seeds are borne on a central or axile placenta (Fig. 1329). The styles are usually 5 or rarely 4, in this differing from Silene (in which the styles are 3), and the calyx teeth are commonly 5. In some species, the styles are 3 and the capsule is more than 1-loculed at base, but in these cases the habit of the plant and minor technical characters enable one to refer them to Lychnis rather than to Silene. The stamens are 10; and the petals 5 and usually with a 2-cleft scale or a pair of teeth at the base of the blade. In the following synopsis of the garden kinds, little attempt is made to follow technical botanical divisions.



1329. Capsule and seeds of Corn-cockle (× 1½). Showing axile placenta.

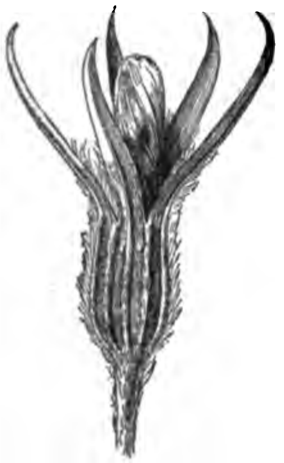
Some of the species of Lychnis are amongst the best known of old-fashioned flowers, as the Mullein Pink, Maltese Cross and Ragged Robin. These are essentially flower-garden subjects. Others, as *L. alpina*, are better kuown as border or rockwork plants. All species are easily grown from seeds, the biennials and perennials blooming the second year. The perennials are often propagated by division.

INDEX.

Agrostemma, 1, 5, 6, 7.
alba, 9.
alpina, 4.
Chalcedonica, 2.
Cœli-rosa, 7.
Coronaria, 5.
coronata, 12.
dioica, 8.
diurna, 8.
elegans, 10.
fimbriata, 7.
Flos-cuculi, 11.
Flos-Jovis, 6.
fulgens, 3, 12.
Githago, 1.
grandiflora, 12.
Haageana, 13.
oculata, 7.
plenissima, 11.
semperflorens, 11.
Senno, 14.
Sieboldii, 12.
Silene, 7.
speciosa, 12.
splendens, 10.
Suecica, 4.
tomentosa, 5.
vespertina, 9.
Viscaria, 7, 10.

A. *Calyx lobes long and leafy: petals not crowned.*

1. **Githàgo**, Scop. (*Agrostémma Githàgo*, Linn.). CORN-COCKLE. Figs. 1329–30; also 825. An annual weed in wheat-fields, and difficult to eradicate because the seeds are not readily screened from the wheat in the thresher or fanning-mill: plant strict, 2–3 ft. tall, white-hairy: lvs. nearly linear: fls. long-peduncled, red-purple and showy, the obovate entire petal limbs exceeded by the narrow calyx lobes—these lobes falling when the fruit is ripe. Eu.—Rarely cult. in old gardens.



1330. Flower of the Corn-cockle (Lychnis Githago) in bud. Natural size.

AA. *Calyx lobes not prolonged and leafy: petals usually crowned.*

B. *Fls. 1 in. or less across, in dense, terminal cymes or umbellate heads. (Forms of No. 12 may be sought here.)*

2. **Chalcedónica**, Linn. MALTESE CROSS. JERUSALEM CROSS. SCARLET LIGHTNING. Fig. 1331. Perennial 2–3 ft. tall, usually loose-hairy, the stems simple or nearly so: lvs. oblong or cordate-lanceolate, clasping (upper ones often narrow and tapering), short-pointed, hairy: fls. 1 in. long, with narrow upward-enlarging ribbed calyx and spreading, obcordate-notched limb. June. B.M. 257.—Probably Japanese, but long in cult., and one of the best of all old-fashioned flowers. The fls. are usually brick-red to scarlet, but there are varieties with rose-colored, flesh-colored and white blossoms; also with double fls. The arrangement of the petal-limbs suggests the Maltese cross, hence one of the common names. Rarely persists for a time as a weed.

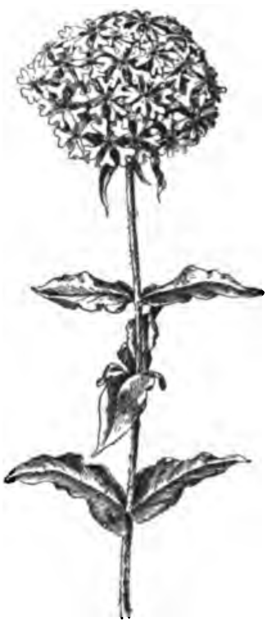
3. **fúlgens**, Fischer (not Hort.). An erect-stemmed perennial, hairy: lvs. ovate to ovate-oblong, roughish, tapering below but scarcely petioled: fls. few, in a rather dense terminal cluster, bright scarlet, each petal divided into two broad lobes, on the outer side of which are two other and very narrow lobes, the ends of the main lobes slightly toothed; calyx oblong or ovate, 10-ribbed, with erect teeth. Siberia, China, Japan. B.M. 2104. B.R. 6:478.—Perhaps not in cultivation in this country. The plant that passes under this name is probably a form of *L. coronata*. From *L. Chalcedonica* it is distinguished by lower stature, much larger fls., and the well-marked side teeth or lobes on the petals.

4. **alpìna**, Linn. Glabrous, tufted, a ft. or less tall: lvs. mostly at the base, thickish, linear or oblong: fls. pink, with 2-lobed petals (segments linear), and short, broad calyx with red teeth. N. Asia., Eu., and Amer. B.M. 394. L.B.C. 9:881 (as *L. Suecica*).—An attractive alpine.

BB. *Fls. mostly larger, borne singly or in loose clusters, or at least the clusters not all terminal.*

C. *Plant white-woolly throughout.*

5. **Coronària**, Desv. (*Agrostémma Coronària*, Linn. *Coronària tomentòsa*, A. Br.). MULLEIN PINK. DUSTY MILLER. ROSE CAMPION. Fig. 1332. Biennial or perennial, 1–2½ ft. tall, forking towards the top: lvs. oblong, oblong-oval or oblong-spatulate, the lower ones obtuse or nearly so, tapering to a more or less clasping base: fls. large (1½ in. across), circular in outline, crimson or rose-crimson, borne singly on the ends of the branches; petals with appendages at the throat; calyx with filiform teeth. Eu. and Asia. B.M. 24.—A common plant of old gardens, and sometimes escaped. The glowing fls. and white foliage make it a conspicuous plant. A hybrid of this and *L. Flos-Jovis* is figured in G.C. III. 2, p. 101.



1331. Lychnis Chalcedonica. (×½.)

6. **Flós-Jòvis**, Desv. Perennial, 12–18 in., making a clump: lvs. in a rosette, also cauline, oval-lanceolate, more or less clasping: fls. small (½ in. or less across), bright red or rose, in a rather dense, umbel-like cluster. Eu. B.M. 398 (as *Agrostemma Flos-Jovis*).—Hardy perennial, rarely seen in old gardens.

CC. *Plant not white-woolly, green.*

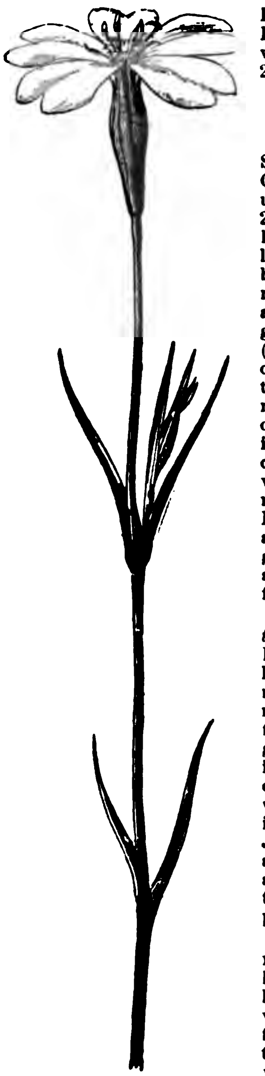
D. *Petals 2-notched or 2-cleft. (Forms of No. 12 may be sought here.)*

E. *Annuals.*

7. **Cœli-ròsa**, Desv. ROSE OF HEAVEN. Fig. 1333. A very floriferous annual, 12–18 in., glabrous: lvs. linear, long-acuminate and very sharp-pointed: fls. on slender stems, about an inch across, the petals only slightly notched, rose-red, with a linear bifid scale at the throat; calyx club-shaped. Mediterranean region. B.M. 295 (as

1332. Lychnis Coronaria.

Agrostemma Cæli-rosa).—A popular garden annual, loving the sun. There is a white-fld. form; also var. **fimbriàta,** Hort., with toothed petals. The species is known also as *Silene Cæli-rosa*. For an account of the leading garden forms, see Rehder, M.D.G. 1897, p. 346.



1333. Lychnis Cœli-rosa. Natural size.

Var. **oculàta** (*L. oculàta*, Backh. *Viscària oculàta*, Lindl.), is a handsome form with purple-eyed fls. B.R. 29:53. B.M. 4075.

EE. *Biennials and perennials.*

8. **dioìca,** Linn. (*L. diùrna*, Sibth.). Red or Morning Campion. Coarse, hairy and usually somewhat viscid, 1–2 ft. tall, forking above: lvs. ovate-lanceolate or oblong, the cauline ones broad-based or clasping: fls. normally red (varying to pink and white), in loose, elongating or forking clusters (or at first single-on the ends of the branches), opening in the morning, not fragrant, more or less diœcious; calyx oblong, reddish, not exceeding ½ in. in length: fr. or capsule large and globose, wide-mouthed, the teeth recurved. Eu. and Asia.—Frequent in old gardens, and also run wild in waste grounds in the eastern states. There are double-fld. forms.

9. **álba,** Mill. (*L. vespertìna*, Sibth.). White or Evening Campion. Very like the last, and perhaps not specifically distinct, but more viscid: lvs. longer: fls. usually white and fragrant and opening at evening; calyx longer and green: capsule ovate to conical, with teeth erect or spreading, not recurved. May, June. Eu.—In old gardens and also escaped. There is a double-fld. form. This and the last are easily grown perennials or biennials.

10. **Viscària,** Linn. German Catchfly. Interesting hardy perennial, 6–20 in. high, glabrous, but with viscid patches beneath the fl.-clusters: lvs. long-linear, the lower ones tapering towards the base: fls. not large, red, in opposite short-stalked clusters, which form an interrupted glomerate panicle; calyx ¾ in. long, reddish, usually somewhat swollen above the middle, with short teeth. Eu., N. Asia. G.C. III. 20:122.—Sometimes seen in old gardens, and a useful plant with a tufted habit; a most profuse bloomer in sunny places. There are forms with deep red and white fls.; also double-fld. Var. **spléndens,** Hort., has rose-pink fls. Var. **élegans,** Hort., has scarlet and white-striped fls.

DD. *Petals 4-lobed or parted.*

11. **Flós-cùculi,** Linn. Ragged Robin. Cuckoo Flower (whence the Latin name). Perennial, slender, 1–2 ft. tall, slightly roughened, and glandular above: root-lvs. oblanceolate; stem-lvs. lance-linear to linear and rather small: fls. in a loose, cymose-paniculate cluster, red or pink, the petals cut into 4 linear segments; calyx short-oblong, 10-ribbed. Eu., N. Asia.—Common in old gardens and also naturalized in parts of the eastern country. The double form (red or white) is prized for its close-packed, fimbriate fls. An old-time and deserving favorite, blooming profusely and for most of the season. Hardy.

Var. **plenissima,** Hort. (*L. plenissima semperflòrens*, Hort.), is an excellent very double form, blooming from spring till fall, and also forcing well.

DDD. *Petals several-toothed or fimbriate, but not lobed.*

12. **coronàta,** Thunb. (*L. grandiflòra*, Jacq.). Perennial, or often biennial under cultivation, erect, glabrous: lvs. oval-elliptic and acute, the cauline ones sessile or nearly so: fls. very large (nearly or quite 2 in. across), the wide-spreading petals sharply several-toothed or somewhat laciniate, brick-red or cinnabar, scattered or in an open panicle. China, Japan. B.M. 223. L.B.C. 15:1433. F.S. 10:979.—Half-hardy or tender perennial, growing 1–1½ ft. high, mostly a spring and summer bloomer. Of this handsome plant there are various forms, and to at least some of them, the name *L. fulgens* is frequently applied.

Var. **speciòsa** (*L. speciòsa*, Carr. *L. fùlgens*, var. *speciòsa*, Voss). Usually not so tall, very bushy: lvs. narrower and sharper: fls. very large and redder (usually scarlet), the petals less toothed and indistinctly 2-notched. R.H. 1870–1:530.

Var. **Sièboldii** (*L. Sièboldii*, Van Houtte. *L. fùlgens*, var. *Sièboldii*, Hort.). Fls. large and pure white, with lacerate and obscurely 2-notched petals.

13. **Haageàna,** Lem. Hybrid of *L. fulgens* and *L. coronata*, and a good intermediate, the fls. being large, with 2-notched petals and 2 short side teeth or lobes and dentate ends to the large lobes. It is a hardy or half-hardy perennial, 12 in. or less high, in summer producing large clusters of orange-red, scarlet or crimson fls., which are nearly 2 in. across. Very desirable. I.H. 6:195. F.S. 22:2322.

14. **Sénno,** Sieb. & Zucc. Erect-growing, villous perennial, with sessile, ovate or lance-ovate lvs. and 1–3 large fls. at the ends of the branches, deep carmine (or in some forms with striped fls.), the petals deeply cut into several divisions which are again toothed at the ends. Japan.—Little known in this country.

L. H. B.

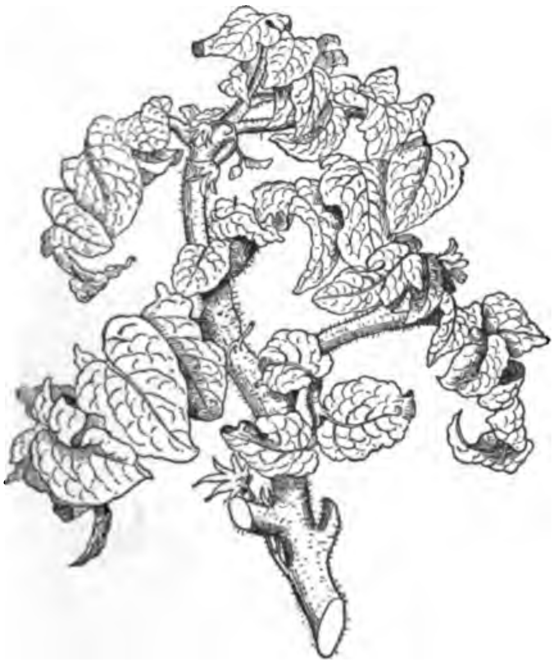
LÝCIUM (Greek, *Lykion*, a name given to a Rhamnus from Lycia, transferred by Linnæus to this genus). *Solanàceæ*. Matrimony Vine. Box Thorn. Ornamental deciduous or evergreen shrubs, with usually spiny and

1334. Old-time garden Tomato. Lycopersicum esculentum. (See p. 958.)

often slender and sarmentose stems and with alternate or fascicled, short-petioled, entire lvs.; the whitish violet or purple fls. are funnelform and appear in axillary clusters or solitary, and are followed by usually very decorative berries of scarlet or red, rarely yellow or black. Most of the species are tender, but *L. halimifolium*, *L. Chinense*, and also *L. Turcomanicum* and *L. Ruthenicum* are hardy North. The two first named are especially attractive in fall, when the long and slender branches are loaded with scarlet or bright red frs., which contrast well with the green foliage. The leaves remain fresh and unchanged in color until they drop, after severe frost. The species are well adapted for covering walls, fences, arbors and other trellis work, but are, perhaps, most beautiful when the branches are pendent from rocks or from the top of walls. They are also used sometimes for hedges, and for warmer regions especially *L. Afrum* may be recommended. It is much used in S. Africa for this purpose under the name of Caffir Thorn. The Box Thorns grow in almost any soil that is not too moist. They should not be planted near flower beds or similar places, where the suckers are apt to become troublesome. Prop. readily by hardwood cuttings or suckers; also by layers and seeds. About 70 species distributed through the temperate and subtropical regions of both hemispheres. Lvs. mostly rather small, often fleshy: fls. axillary, solitary or clustered; calyx campanulate, 3–5-toothed; corolla funnelform, with usually 5-lobed limb; stamens mostly 5: fr. a berry, with few to many seeds.

A. *Lvs. rather large: corolla 5-lobed, dull purplish.*

halimifòlium, Mill. (*L. vulgàre*, Dun. *L. flàccidum*, Koch). Shrub, with long and slender, spiny or unarmed branches, recurving or sarmentose, glabrous: lvs. cuneate, narrow, oblong-lanceolate, acute or obtuse, grayish green, 1⅓–2 in. long: fls. 1–4, long-pedicelled; corolla ⅓ in. across, limb about as long as tube; filaments hirsute at the base: fr. oval, orange-red or sometimes yellow, to ⅓ in. long. May–Sept. China to S. E. Eu. Gn. 31, p. 334 and 34, p. 63. B.B. 3:138.—This species and also the following are often confounded with *L. Europæum* and *L. Barbarum*, which are chiefly distinguished by the filaments being glabrous at the base, by the longer tube and by the narrower and smaller lvs. They are not hardy North and are rare in cultivation, while *L. halimifolium* and the following are hardy.

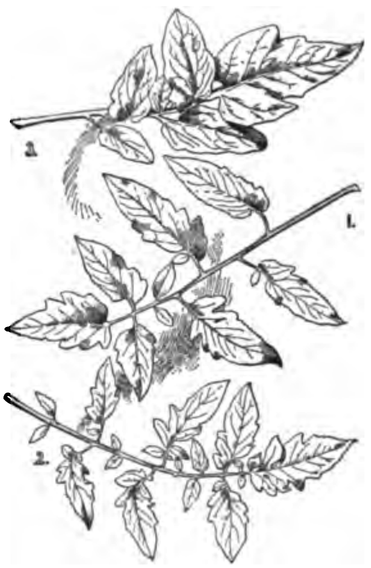


1335. Upright Tomato, Lycopersicum esculentum, var. validum.

Chinénse, Mill. Similar to the former, of more vigorous growth: branches to 12 ft. long: lvs. ovate to lanceolate, bright green, 1⅓–3 in.: fls. somewhat larger: fr. scarlet or bright orange-red, ovate to oblong, sometimes almost 1 in. long. June–Sept. China. G.F. 4:102.—The larger fruited form is sometimes distinguished as var. **megistocárpum**, Hort. (var. *macrocàrpum*, Hort).

AA. *Lvs. small, ¾ in. long or shorter.*

Chilénse, Bert Shrub, with slender, often procumbent and mostly spineless branches: lvs. cuneate at base, oblong, glandular-pubescent on both sides, grayish green, ⅓–¾ in. long: fls. usually solitary; pedicels longer than the 5-lobed, whitish pubescent calyx; corolla about ⅓ in. long, pubescent and yellowish outside, limb 5-lobed, purplish within, about as long as tube: fr. orange-red. July–Oct. Chile.—The grayish color and glandular pubescence gives the foliage a frosted appearance. Int. 1900 by Franceschi, Santa Barbara, Calif.



1336. Leaves of Tomatoes.
1, *Lycopersicum esculentum*, var. *grandifolium*.
2, var. *vulgare;* 3, cross of the two.

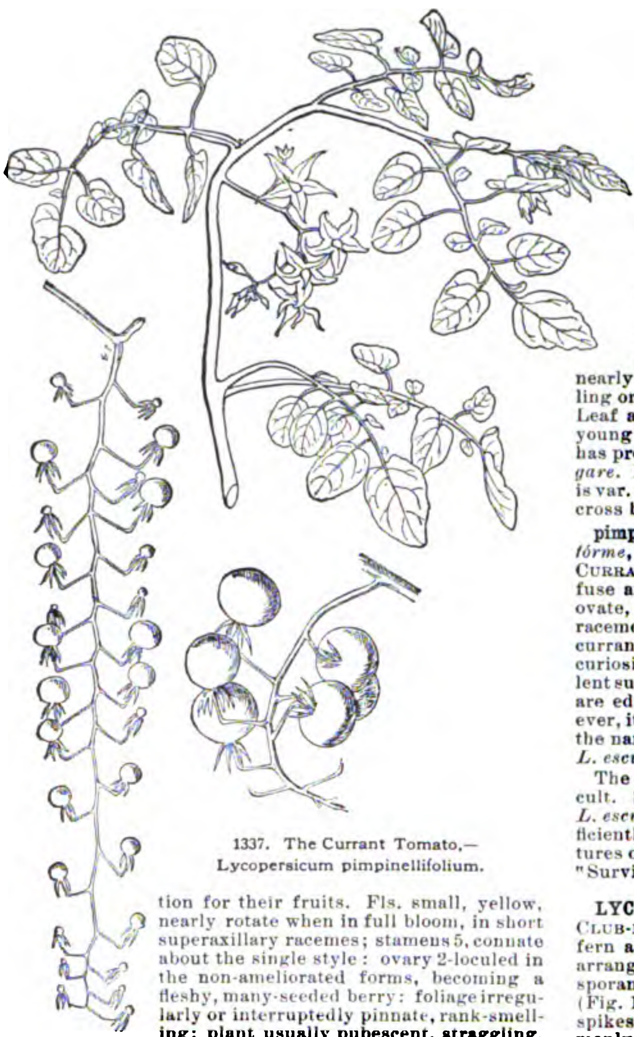
Richii, Gray. Shrub, with slender spiny branches: lvs. short-petioled, cuneate, obovate, obtuse, glabrous or minutely puberulous when young, about ⅓ in. long: fls. usually 2–3; calyx as long as pedicels, with elongated teeth; corolla ⅓ in. long, tube longer than 4-lobed limb: fr. globular, bright red, ¼ in. across. May–Sept. S. Calif.

hórridum, Thunb. Erect, spiny, much-branched shrub, to 3 ft., glabrous: lvs. sessile, spatulate, glabrous, about ¼ in. long: fls. short-pedicelled, small, whitish, with rather slender tube and 3–4-lobed limb. S. Afr.—As I have seen no specimens of the plant in trade under this name, I am not sure whether it is the true *L. horridum* of Thunberg described above, or perhaps *L. Afrum*, which is much used in S. Africa for hedges; the latter is easily distinguished by its large purple fls.

L. Áfrum, Linn. Upright, rigid, spiny: lvs. linear-spatulate, small: fls. solitary, tubular, with short limb, purple, 1 in. long. N. and S. Afr. B.R. 5:354. S.B.F.G. II. 4:324.—*L. Bárbarum*, Linn. Spiny or unarmed slender shrub. Similar to L. halimifolium: fls. 3–6; tube inside and filaments at base glabrous, tube longer than limb. N. Afr.—*L. Europæum*, Linn. (L. Mediterraneum, Dun.). Spiny shrub, with spreading branches: lvs. spatulate, thickish: fls. short-pedicelled, with the slender tube much longer than limb. Mediter. region.—*L. fuchsioides*, HBK. = Iochroma fuchsioides.—*L. ovàtum*, Dun. (L. rhombifolium, Dipp.). Allied to L. Chinense. Lvs. rhombic-ovate: fr. oblong, large, with concave apex.—*L. pállidum*, Miers. Spiny spreading shrub, to 3 ft.: lvs. spatulate, glaucous, 1–2 in. long: fls. pedicelled, pale greenish purple, funnelform, almost 1 in. long: fr. globular, bright red. Ariz. and Utah to Mexico. G.F. 1:341. Has proved hardy in the Arnold Arboretum.—*L. Ruthénicum*, Murr. Upright spiny shrub: lvs. linear, small, thick: fls. small, with rather long tube: fr. globular, black.—*L. Turcománicum*, Turcz. Slender spiny shrub, allied to L. halimifolium: lvs. and fls. smaller, tube more slender and longer: fr. globular. Turkestan, N. China.—*L. subglòbosum*, Dun. Allied to L. halimifolium, dwarfer, more erect, less spiny: lvs. smaller: fr. subglobose, small. S. Europe.

ALFRED REHDER.

LYCOPÉRSICUM (*wolf peach;* probably an allusion to its inferiority as compared with the peach). *Solanàceæ.* TOMATO. Perhaps nearly a dozen herbs of the western side of S. America, two of which are in common cultiva-



1337. The Currant Tomato.—Lycopersicum pimpinellifolium.

tion for their fruits. Fls. small, yellow, nearly rotate when in full bloom, in short superaxillary racemes; stamens 5, connate about the single style: ovary 2-loculed in the non-ameliorated forms, becoming a fleshy, many-seeded berry: foliage irregularly or interruptedly pinnate, rank-smelling: plant usually pubescent, straggling. In native conditions, Tomatoes are probably perennial, but in domestication they are treated as if annual. Tender to frost. See *Tomato*.

esculéntum, Mill. Common Tomato. Fig. 1334. Plant spreading, with grayish green, mostly conduplicate ("curled") leaves and slender, ascending shoots: lvs. pinnate, with small, nearly entire leaflets interposed, the main leaflets notched or even lobed towards the base: fls. in a short raceme of 4–6: fr. medium to small, flattened endwise and furrowed on the sides.—In cultivation for more than 300 years. Two hundred years ago red and yellow varieties were known. The great evolution of the Tomato did not take place until this century, giving rise to the garden race.

Var. **vulgàre**, Bailey. Fig. 1336, No. 2. This is the common garden Tomato of North America, distinguished by very heavy growth, greener foliage, much larger and plane lvs., the comparative absence of stiffish ascending shoots (in the mature plant), few fls., and larger, "smoother" (i. e., not furrowed) fr., which has numerous locules or cells.—There is every reason for believing that the original Tomato had a 2-loculed (2-celled) fruit, but the course of amelioration has multiplied the locules; it has also modified the foliage and the stature of the plant (see "Survival of the Unlike," Essays 4 and 30).

Var. **cerasifórme**, Hort. (*L. cerasifórme*, Dunal). Cherry Tomato. Still grown for its little globular frts (in red and yellow), which are often 2-loculed: plant less large and dense-foliaged, the lvs. smaller, grayer: growth more erect.—Probably a very close approach to the wild plant. Fruits used for pickles and conserves.

Var. **pyrifórme**, Hort. (*L. pyrifórme*, Dunal). Pear and Plum Tomato. Differs from the last only in having pear-shaped or oblong fruits.—Probably occurs wild in very nearly the form seen in old gardens.

Var. **válidum**, Bailey. Upright Tomato. Fig. 1335. A remarkable cultural form, of low, stiff. erect growth, and small, condensed, curled lvs.—Originated as a chance seedling in France about 50 years ago. Looks like a potato plant.

Var. **grandifòlium**, Bailey. Large-leaf Tomato. Lvs. very large, plane, the lfts. few (about 2 pairs) and large, with margins entire or very nearly so, and secondary lfts. usually none.—Of seedling origin about 30 years ago. The Mikado and Potato Leaf are the leading varieties at present. In very young plants, the leaves are usually entire. This race has produced crosses of commercial value with var. *vulgare*. In Fig. 1336, No. 2 is a leaf of var. *vulgare*, No. 1 is var. *grandifolium*, and No. 3 is a leaf of a hand-made cross between the two.

pimpinellifòlium, Dunal (*L. racemigerum* and *racemifórme*, Lange. *Solànum racemiflòrum*, Vilm., not Dunal). Currant Tomato. Fig. 1337. Plant weaker, very diffuse and twiggy, scarcely pubescent: lvs. with small, ovate, nearly entire lfts., and very small secondary lfts.: racemes elongating, distichous, bearing 10–40 small, currant-like, red berries. S. Amer.—Grown as a curiosity and for ornament. The plant makes an excellent summer cover for brush or rubbish piles. The fruits are edible, but are too small for domestic use. However, it has been introduced as a garden vegetable under the name of German Raisin Tomato. It hybridizes with *L. esculentum* (see Fig. 1338).

The other species of Lycopersicum are unknown in cult. Some of them are very like aboriginal forms of *L. esculentum*, and it is doubtful whether they are sufficiently distinct to be worth keeping as species. Pictures of other Lycopersicums will be found in Essay 4, "Survival of the Unlike." L. H. B.

LYCOPÒDIUM (Greek, *wolf-foot*). *Lycopodiàceæ*. Club-moss. Ground-pine. Running-pine. A genus of fern allies, with erect or trailing stems, narrow lvs., arranged in 4 to many ranks, and bearing spores in sporangia, located either in the axils of ordinary lvs. (Fig. 1339) or in the axils of modified lvs. clustered in spikes (Fig. 1340). About 100 species are known. Commonly used for holiday decorations. The spores of some species form the officinal Lycopodium powder. The plants which florists grow as Lycopodiums are Selaginellas (which see).

A. *Lvs. many-ranked.*

B. *Sporangia in the axils of unaltered lvs.*

Selàgo, Linn. Stems erect, 3–9 in. long, dichotomously branched: lvs. ascending, hollow at base. glossy green, not reflexed. Northern hemisphere, usually in high altitudes.

lucídulum, Michx., is more common in lowlands, and has lvs. wide in the middle and erose.

squarròsum, Forst. Stems pendulous, 1–2 ft. long, 2–3 times dichotomously branched: lvs. firm, dark green, spreading, ½–¾ in. long: sporangia in the axils of reduced lvs., forming a spike. East Indies.

BB. *Sporangia aggregated in terminal spikes.*

C. *Stems pendulous: lvs. acute.*

Phlegmària, Linn. Stems ½–2 ft. long, dichotomously forked: lvs. ½–¾ in. long, ovate: spikes copious, lax, 3–6 in. or more long. Tropics of Old World.

CC. *Stems erect, tree-form.*

cérnuum, Linn. Stems erect, reaching 3–4 ft., copiously branched: lvs. crowded, linear: spikes sessile, ¼–¾ n. long, curved downward. Tropics of both hemispheres, occasionally in our gulf states.

obscùrum, Linn. (*L. dendroideum*, Michx. *L. Japónicum*, Thunb.). Stems 6–12 in. high, much-branched: lvs. loose, erect: spikes erect, ½–1½ in. long. Temperate N. Amer. to Japan.—The common Ground Pine.

1338. Lycopersicum esculentum beneath; L. pimpinellifolium at top; hybrid between.

CCC. *Stems (main ones) wide-trailing, with erect branches.*

annótinum, Linn. Stems trailing, often several feet long, with numerous ascending branches 6–8 in. high, which bear sessile, solitary spikes. Arctic and north temperate zones of both hemispheres.

clavàtum, Linn. Main stem trailing to the length of several feet, usually much branched: spikes 1–4 on an elongated peduncle. Arctic and north temperate regions of both hemispheres.—The common Club-Moss.

AA. *Lvs. 4-ranked, on fan-like branches.*

complanàtum, Linn. Fig. 1340. Stems trailing on the surface of the ground: branches spreading out in a horizontal plane: lvs. of the under side of stems reduced to slender, spreading, cuspidate apices: first and second forks of peduncles approximate. Northern hemisphere.—*L. Chamæcyparissus*, R. Br., is an allied species, with stems growing underground.

L. M. UNDERWOOD.

LYCÒRIS (named after a nereid in Greek mythology). *Amaryllidàceæ.* A genus of 5 species of remarkable bulbs from China and Japan, with large, 6-parted flowers. Four species are in cultivation, two of which are hardy in New England. Two bloom in summer and two in early autumn. Two have red fls., one has lilac or purple fls., one yellow or orange. Three have the perianth segments more or less recurved and fluted or crisped at the margin. In all cases the fls. appear without foliage, being borne on a scape 1–3 ft. long, in umbels of 4–12 fls. each 3–4 in. across. The white filaments and yellow anthers are conspicuous features. The leaves make their growth, die down, and after a long rest the bulbs send up flower-stalks alone. These plants are highly esteemed in China and Japan, and bulbs are constantly being sent to the western world, but with us they seem to be wayward and uncertain, particularly as to the time of blooming. *Lycoris aurea* reverses the custom of nature. It rests in the wet season and flowers in the dry season. How the bulbs can remain dormant during the early Chinese summer, with the thermometer at 85° in the shade and a yearly rainfall of 100 inches, is a mystery. Botanically this genus is placed next to Hippeastrum, an American genus, in which the seeds are numerous in a locule, and usually flat, while in Lycoris they are few in a locule and turgid. Horticulturally Lycoris is most nearly comparable to Nerine, but the seeds of the former are black and of the latter green. Baker, Handbook of the Amaryllideæ, 1888.

A. *Blooming in July and August.*

B. *Fls. dull red.*

sanguìnea, Maxim. Bulb ovoid, 1 in. in diam.; neck 1–2 in. long: lvs. linear: stamens shorter than the perianth segments. Japan.—The only species with segments neither wavy nor reflexed. Baker says the fls. are bright red. The Yokohoma Nursery Co. is probably mistaken in giving the blooming period as May and June. They also advertise var. **álba**. J. N. Gerard says the lvs. of this and the next appear in March; also that the fls. of *L. sanguinea* are dull brownish red.

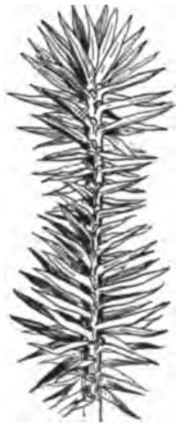
BB. *Fls. rosy lilac.*

squamígera, Maxim. (*Amarýllis Hállii*, Hort., at least in part). Fig. 1341. Bulb globose: lvs. produced in spring, 9–12 lines wide: fls. rosy lilac, banded yellow. Japan. B.M. 7547. G.C. III. 21:137. G.F. 3:177.—The only fragrant kind. Var. **purpùrea**, Hort., introduced about 1898. This species is hardy in New England.

AA. *Blooming from Sept.–Nov.*

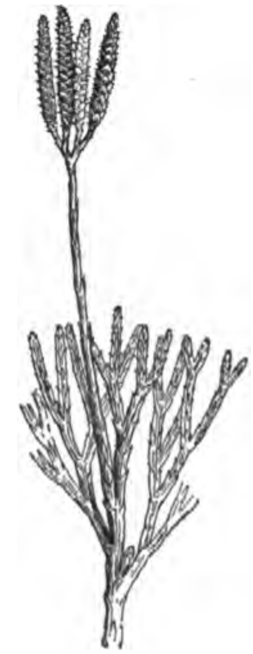
B. *Fls. orange-colored.*

aùrea, Herb. (*Nerine aùrea*, Bury). GOLDEN SPIDER LILY. Bulb 2 in. in diam.: lvs. sword-shaped, 6–9 lines wide, glaucous, produced in May. China. B.M. 409 and B.R. 8:611 (as *Amaryllis aurea*). G.C. III. 17:263 and 18:545. Gn. 47:997.—Baker says it blooms in Aug. and has bright yellow fls., but all the colored plates show orange-colored fls.



1339. Lycopodium lucidulum.

Common in cool woods. Sporangia in the axils of foliage leaves.



1340. Lycopodium complanatum.

Denizen of dry banks. Sporangia in spikes.

BB. *Fls. bright red.*

radiàta, Herb. (*Nerìne Japónica,* Miq.). Bulb globose, 1⅓ in. diam.; neck short: lvs. produced in winter, linear: stamens much longer than the perianth segments. China and Japan. B.R. 7:596 (as *Amaryllis radiata*). A.G. 13:211.—The perianth segments are more recurved than in any other species. The tube is very short, while in all the other kinds here described it is ⅓ in. long. W. M.

Lycoris aurea has been cultivated for many years in American gardens, though it is not a common plant. Lately, with large importations of *L. radiata*, the interest in the genus has widened. These species have the handsomer flowers, and are preferably cultivated under glass, though the bulbs are probably hardy in warm, protected borders; at least they have more than once been frozen in pots at Elizabeth, N. J., without apparent harm. In its habitat in China, *L. aurea* rests in the wet season, and the most success in culture has been found in growing it in a warmhouse, taking care to cultivate the foliage and rest the bulbs in warmth and moist earth. The same general directions may be followed for *L. radiata*. As with all bulbs, a vigorous growth of foliage is essential to the future appearance of flowers. *L. squamigera* and *L. sanguinea* are perfectly hardy; their leaves appear in March, mature and disappear. The flowers come in the nature of a surprise in July and August. The former species has a columnar scape 2–3 ft. tall and a cluster of large, amaryllis-like flowers, of a bright rosy purple, rather attractive in the back row of a garden, but not of first rank. *L. sanguinea* has a scape 1½–2 ft., with small orange-red flowers, dull and curious rather than striking. The two former species have the beauty of the Nerines, but the two latter have none of this resemblance.

J. N. GERARD.

1341. Lycoris squamigera (× ½).

LYGÒDIUM (Greek, *twining*). *Schizæàceæ.* CLIMBING FERNS. A genus of twining ferns, with the sporangia borne singly under overlapping scales on the under surface of reduced portions of the leaf. Some 30 species are known from all parts of the world. For cult., see *Ferns.*

A. *Sterile pinnules palmate.* (Native species.)

palmàtum, Sw. HARTFORD FERN. Lvs. 2 ft. or more high, twining, bearing pairs of cordate-palmate pinnules 1½–2 in. long, on short petioles; fertile pinnules 3–4-pinnatifid, with the ultimate divisions linear. Mass. to Fla. and Tenn.—Requires light, moist soil and partial shade.

AA. *Sterile pinnules pinnate.* (Exotic glasshouse species.)

scándens, Sw. Pinnules 4–8 in. long, 2–4 in. broad, with a terminal segment and 4 or 5 on each side, which are simple and usually ovate. India and China.—Most of the American material cultivated under this name belongs to the next species.

Japónicum, Sw. Pinnules 4–8 in. long, nearly as wide, deltoid, with a pinnatifid terminal segment and 2 or 3 lateral ones on each side, all unequal and the lowest long-stalked and pinnate in the lower part. Japan and the East Indies.—The common species in cultivation.

L. M. UNDERWOOD.

LYON, THEODATUS TIMOTHY (Plate X), pomologist, was born in Lima, N. Y., January 13, 1813, and died in South Haven, Mich., February 6, 1900. He was the son of a farmer. His school going was very limited. In 1828, his parents went to the territory of Michigan, where he was employed in many pioneer pursuits, as farming, lumber-making, post-boy, tanner, merchant. He became more and more interested in farming, and in 1844 started a nursery on the farm at Plymouth, Mich. He collected varieties from the local orchards, and found their names much confused. His interest was challenged, and gradually he became absorbed in a study of pomology, which in that day meant mostly knowledge of varieties. Articles on the varieties of Michigan apples in the "Michigan Farmer" attracted the attention of Charles Downing, and a correspondence and exchange of varieties resulted. His name appears in the list of correspondents in the revised editions of Downing's "Fruits and Fruit Trees." For some years, Mr. Lyon was president of a railway company. In 1874, he moved to the "fruit belt" of southwestern Michigan, where he became president of the Michigan Lake Shore Nursery Association, and where he lived until his death. The nursery association was not successful financially. In 1888, Mr. Lyon wrote a full (412 pp.) and careful "History of Michigan Horticulture," which was published in the seventeenth report of the State Horticultural Society, a society of which he was president from 1876 to 1891, and honorary president until his death. In 1889, he took charge of the South Haven sub-station of the Michigan Experiment Station; and here, with his fruits and trees, he lived quietly and happily to the last.

Mr. Lyon was one of the last of the older generation of pomologists. Like his colleagues, he was an expert on varieties. He was one of that sacred company which placed accuracy and cautiousness before every consideration of ambition or personal gain. His friends knew that he had not the temper of a commercial man. At one time it was said of him that he was the most critical and accurate of American pomologists. The fruit lists of the Michigan Horticultural Society, his labors in revision of nomenclature for the American Pomological Society, and his various bulletins of the Michigan Experiment Station, show his keen judgment of varieties. Personally, he was retired, modest, cautious in speech, generous, simple in habit and manner.

L. H. B.

LYÒNIA (after John Lyon, who introduced many American plants into England, died before 1818 in Asheville, N. C.). Syn., *Xolisma. Ericàceæ.* Ornamental evergreen or deciduous shrubs, with alternate short-petioled lvs., and small white fls. in clusters, usually forming terminal racemes or panicles. Only the deciduous *L. ligustrina* is hardy North, but is less desirable than other hardy species of allied genera. It prefers moist, peaty soil, while the evergreen tender *L. ferruginea* thrives best in a sandy, well-drained soil. Cult. and prop. like Leucothoë and Pieris. About 10 species in E. N. Amer., W. Indies and Mexico. Allied to Pieris and often included under Andromeda. Calyx lobes 4–5, valvate; corolla globular or urceolate, pubescent; stamens 8–10: capsules 4–5-valved, with ribs at the sutures; seeds numerous.

ligustrina, Muhl. (*Andrómeda paniculàta*, Ait. *L. paniculàta*, Nutt.). Deciduous, much-branched shrub, to 10 ft.: lvs. obovate to oblong-lanceolate, entire or obscurely serrate, pubescent beneath, 1–2 in. long: fls. in leafless racemes, forming terminal panicles; corolla globose, whitish, one-sixth in. long. May–July. Canada to Fla., west to Tenn. and Ark. B.B. 2:570.

ferruginea, Nutt. (*Andrómeda ferruginea*, Walt.). Evergreen shrub or small tree: lvs. cuneate, obovate to oblong, with revolute margin, scurfy when unfolding, especially below, 1–2 in. long: fls. nodding, globular, white, in clusters in the axils of the upper lvs. Feb., March. S. C. to Fla. S.S. 5:234. L.B.C. 5:430.—Handsome evergreen shrub, but rarely cult., hardy only South. Var. **arboréscens,** Michx. (*Andrómeda rigida*, Pursh). Of vigorous growth, more rigid and with crowded lvs., growing into a small tree. Var. **fruticòsa,** Michx. (*A. rhomboidàlis*, Nouv. Duh.). Shrubby: lvs. sparser, conspicuously reticulated. ALFRED REHDER.

LYONOTHÁMNUS (*Lyon's shrub;* named for W. S. Lyon, who sent specimens to Asa Gray from Santa Catalina Island, California). *Saxifragàceæ.* A monotypic genus confined to the islands of the Santa Barbara channel, and represented by two forms,—*L. floribundus* as described by Gray, and *L. asplenifolius* as described by Greene. These forms differ only in the structure of the lvs., as the species is dimorphic. Locally the tree is known as ironwood. It is rather plentiful' in Santa Crųz Island, attaining 40 and 50 ft. in height. It is less frequent and more dwarfed in other islands of the group.

Fls. hermaphrodite; calyx 1–3-bracteoled; tube hemispherical; lobes 5; disk lanate; petals 5, orbiculate, imbricate in the bud; stamens 15, inserted with the petals on the margin of the disk: carpels 2, free: ovules 4: stigma subcapitate.

floribúndus, Gray. Lvs. opposite, lanceolate, petiolate, subentire, oleander-shaped: fls. white, very numerous in a large, flattish, terminal cyme.—Highly praised for outdoor culture and for pots. The clusters are 4–5 in. across. The form **aspleniifòlius** has pinnate lvs. with pinnæ cut to the rib.

F. Franceschi.

LYSICHÌTUM (Greek, *a loose or free cloak;* probably referring to the spathe). Also written *Lysichiton. Aràceæ.* A genus of one species, a plant resembling the skunk cabbage, offered in 1892 by Oregon dealers. Nearly stemless swamp herb with large lvs. from a thick, horizontal rootstock; spathe sheathing at base, with a broad colored lamina or none, at first enveloping the cylindrical spadix, which becomes long-exserted upon a stout peduncle: fls. perfect, crowding and covering the spadix; perianth 4-lobed; stamens 4: ovary 2-celled, 2-ovuled: ovules horizontal, orthotropous.

Camtschatcénse, Schott. Lvs. 1–2½ ft. long, 3–10 in. wide, oblong-lanceolate. May, June. E. Siberia, Japan, Ore., Calif.

LYSILÒMA is a small leguminous genus allied to Acacia, but not in cultivation. They are tender trees and shrubs, with flowers in heads or in cylindrical spikes. The pods are straight and flat, and the valves open away from the persistent sutures. Some of these plants are often called Acacias. Thus A. Acapulcensis = *L. Acapulcensis*, Benth.; A. divaricata = *L. Schiedeana*, Benth.; A. latisiliqua = *L. latisiliqua*, Benth.

LYSIMÀCHIA (probably after King Lysimachus). *Primulàceæ.* Loose-strife. Found in temperate and subtropical regions of all parts of the world. Erect or creeping leafy herbs, with opposite or whorled, entire, usually black-punctate lvs., spicate, racemose or solitary fls., a rotate, 5-parted corolla with an equal number of slightly monadelphous stamens opposite the lobes, a 1-loculed capsule, and many seeds on a central placenta. Only a few in cultivation, and these all perennials. They differ from related genera in the absence of staminodia between the stamens, which are usually slightly united.

A. *Flowers yellow.*

B. *Stem creeping: lvs. round-ovate, obtuse.*

nummulària, Linn. Money-wort. Creeping Charlie. Creeping Jenny. Glabrous, forming large patches: lvs. opposite, rarely cordate, petiolate, ½–1 in. long: fls. 8–12 lines broad; sepals cordate or lanceolate, acute, half as long as the 5 oval, sparingly dark-dotted corolla lobes; filaments glandular. June–Aug. Europe; also naturalized extensively in the eastern U. S. R.H. 1891, p. 303. B.B. 2:589.—Very useful for rustic vases and baskets, also for carpeting ground in shady places. Var. **aùrea**, Hort. Lvs. all or in part bright yellow.

BB. *Stem erect: lvs. lanceolate, acute.*

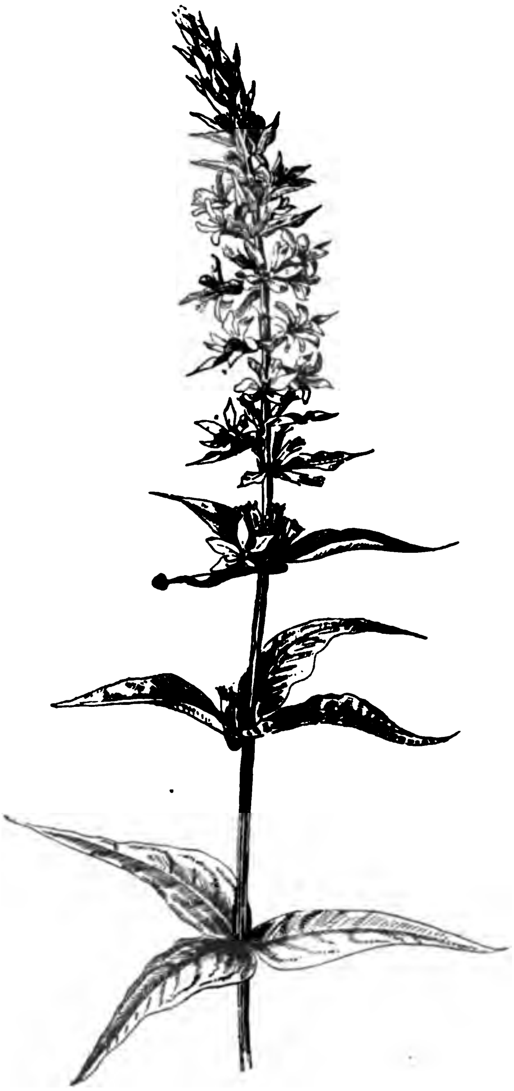
C. *Plant glabrous or nearly so: fls. 3–6 lines broad.*

stricta, Soland. Simple or branched, glabrous, 8 in. to 2 ft. high; lvs. opposite, lance-linear, acute at both ends, glaucous beneath, scarcely veiny, 1–3 in long: fls. 3–5 lines broad, very numerous, in a distinct, elongated, terminal raceme; pedicels 3–9 lines long, slender; corolla lobes elliptical, streaked with purple; filaments glandular. Common on moist ground in the eastern U. S. B.M. 104 (as *L. bulbifera*). D. 141. B.B. 2:588.—Often bears bulblets in the leaf-axils after flowering.

quadrifòlia, Linn. Usually simple, sometimes slightly pubescent, 1–3 ft. high: lvs. verticillate, in 3's–4's, rarely some opposite, lanceolate, oblong or ovate, acute, 1–4 in. long, green beneath, veiny: fls. axillary, 3–6 lines broad, on very slender pedicels, which are ½–1½ in. long; calyx and corolla as in the last. Dry soil, eastern U. S. D. 139. B.B. 2:588.

CC. *Plant densely pubescent: fls. 9–12 lines broad.*

vulgàris, Linn. Common Yellow Loosestrife. Tall and erect, 2–3 ft. high, and stout; branched above, downy, especially on the stem: lvs. verticillate, in 3's–4's, ovate-lanceolate or lance-oval, acute at both ends, nearly sessile: fls. in the upper axils, or densely paniculate at the summit; calyx often red-margined; corolla large, the lobes broad, glabrous. Europe, Asia. R. H. 1891, p. 303.—Quite showy when grown in clumps.



1342. Lythrum Salicaria (× ½). (See p. 962.)

punctàta, Linn. (*L. verticillàta*, Bieb.). Tall and stout: lvs. verticillate, in 4's, lanceolate, ovate or cordate-ovate, acute, subsessile: corolla lobes oval, denticulate, glandular-ciliate, acute; stamens united. Very similar to *L. vulgaris*, but differs in the calyx lobes not red-margined: fls. in axillary, equidistant whorls, not paniculate, and corolla glandular. Eu. W. Asia. B.M. 2295 (as *L. verticillaris*).

AA. *Flowers white.*

clethroides, Duby. Tall and stout, 3 ft. high or less, sparingly pubescent, rarely glabrous: lvs. opposite, large, 3–6 in. long, and sessile, broadly lanceolate, attenuate at each end, radical spatulate: fls. ⅓ in. in diam., in a very long, slender, terminal 1-sided spike; pedicels short, bracts subulate; corolla lobes ovate-lanceolate, obtuse; stamens not monadelphous. Japan. Mn. 8, p. 141.—Fine for cut-flowers, also for border.

L. barýstachys, Bunge (L. brachystachys, Carr.). Lvs. lanceolate: fls. white, dense. China. R.H. 1881-90.—*L. ciliata*, Linn. =Steironema ciliatum.—*L. Ephémerum*, Linn. Lvs. linear: fls. white, dark eye. Eu. R.H. 1891, p. 303. B.M. 2346.—*L. hýbrida*, Michx. = Steironema lanceolatum.—*L. lanceolàta*, Walt. = Steironema lanceolatum.—*L. Leschenaúltii*, Duby. Lvs. lanceolate: fls. carmine. India. R.H. 1891, p. 303.—*L. nùtans*, Nees. Lvs. lanceolate: fls. dark purple. Cape of Good Hope. B.M. 4941.—*L. paridifórmis*, Franch. Lvs. oval: fls. yellow, axillary or in head. China. B.M. 7226.—*L. polyántha*, Fernald. Similar to L. quadrifolia, but fls. in a distinct terminal raceme. Eastern U. S.—*L. prodúcta*, Fernald. Similar to L. stricta, but lower lvs. often verticillate and raceme very leafy, bracts passing into the foliage-lvs. Eastern U.S.—*L. thyrsiflòra*, Linn.= Naumburgia thyrsiflora.

K. M. Wiegand.

LÝTHRUM (Greek, *blood;* possibly from the styptic properties of some species, or the color of the fls.). *Lythràceæ*. About 12 widely scattered species of herbs or subshrubs, of which 3 are cult. in hardy borders. Branches 4-angled: lvs. opposite or alternate, rarely whorled, linear-oblong or lanceolate, entire: fls. rosy purple or white, in the upper axils usually solitary, lower down more or less whorled; calyx tube cylindrical, 8–12-ribbed; petals 4–6, obovate; stamens as many or twice as many: capsule 2-celled, with an indefinite number of seeds.

Lythrums grow about 2–3 ft. high in the wild, but improve wonderfully in cultivation, often attaining 4–5 ft. and flowering freely. Some of them are called willow-herbs or soldiers in England from their strong, erect habit and willow-like leaves. They are of easy culture in any moist soil, and are usually planted amid shrubbery, where they hold their own. They are denizens of low grounds, swamps and meadows. They flower in summer and are prop. by division. A nameless species from Japan has been considerably advertised of late, but the specimen in the writer's hands is *L. alatum*.

A. *Stamens twice as many as the petals.*

B. *Fls. in an interrupted, leafy spike.*

Salicària, Linn. Spiked or Purple Loosestrife. Fig. 1342. Height 2–3 ft.: lvs. opposite or sometimes in whorls of three, lanceolate, 2–3 in. long: fls. purple: stamens barely if at all exserted. North temp. regions. Australia. B. B. 2:473.—Best of the genus. Vars. **supérbum** and **ròseum**, Hort., have rose-colored fls. Var. **ròseum supérbum**, Hort., may be the same as the preceding varieties. It is large-fld., rose-colored, more robust (4–6 ft.), and somewhat later in blooming. It is an excellent form. It is generally sold as *L. roseum superbum* (not as a var. of *L. Salicaria*).

BB. *Fls. solitary in the upper axils, racemose.*

virgàtum, Linn. Lower lvs. opposite, rounded at the base: calyx not bracted. Eu., N. Asia.

AA. *Stamens not more numerous than the petals.*

alàtum, Pursh. Lvs. mostly alternate, obtuse: stamens exserted. N. Am. B.B. 2:472.

F. W. Barclay and W. M.

M

MAÀCKIA. See *Cladrastis.*

MÀBA (native name). *Ebenàceæ.* A genus of about 60 species of trees and shrubs found in the warmer regions of the world. They mostly have hard, ebony-like wood. Closely allied to Diospyros, the floral parts mostly in 3's instead of 4's or 5's. The lvs. are usually smaller than in Diospyros. Lvs. alternate: fls. axillary, solitary or in short cymes, usually diœcious; corolla bell-shaped or tubular.

Natalénsis, Haw. Much-branched shrub, with flexuous branches: lvs. ¾–1 in. long, 6–7 lines wide, ovate, oblong or elliptical, obtuse, dark green above, paler beneath, glabrous, netted-veined beneath: female fls. solitary; calyx cup-shaped, glabrous, entire; abortive stamens 6–7: ovary glabrous. Natal; offered in S. Fla.—Presumably the plant in cult. is the female.

MACADÀMIA (after John Macadam, M.D., secretary Philosophical Institute, Victoria, N. S. W.). *Proteàceæ.* Two or 3 species of Australian trees or tall shrubs, one of which produces the Australian nut, which has a flavor like a filbert or almond, and is cult. in S. Calif. In favorable localities it bears in 7 years. The genus has no near allies of horticultural value. Lvs. whorled: fls. small, pedicelled in pairs, racemose, hermaphrodite; perianth not recurved; stamens affixed a little below the blades: disk ringed, 4-lobed or 4-parted.

ternifòlia, F. Muell. AUSTRALIAN NUT. Tree, attaining 60 ft.: foliage dense: lvs. sessile, in whorls of 3 or 4, oblong or lanceolate, serrate, with fine prickly teeth, glabrous and shining, a few inches to 1 ft. long: racemes often as long as the lvs.: fr. with a 2-valved, leathery covering; nut often over 1 in. thick. Australia. G.C. 1870:1181.

MACHÆRIUM Tipu. See *Tipuana speciosa.*

MACKÀYA. See *Asystasia.*

MACLEÀNIA (after John Maclean, British merchant at Lima, Peru; patron of botany). *Vaccineàceæ.* About a dozen species of shrubs found in the mountains from Mexico to Peru. They are unknown to the American trade, but, judging from the pictures in the Botanical Magazine, should make fine hothouse subjects for our largest and finest conservatories. They have clusters of brick-red or crimson, tubular fls. each an inch or more long. A branch of *M. speciosissima*, which is probably the showiest kind, bears about 60 to 75 such fls. The young foliage appears to have a handsome reddish tinge. The corollas are strongly 5-angled, and the 5 tips are short, triangular, erect or spreading and more or less yellow. Lvs. evergreen, alternate, short-stalked, entire: stamens 10, much shorter than the corolla. Macleanias are probably of difficult culture. Try *M. speciosissima* in a large pot on a shelf near the glass, so that its branches may hang gracefully. *M. pulchra* has the same habit and color of fls., but is perhaps less desirable. *M. punctata* is perhaps the most desirable of those with erect branches and stiff habit. Try this in a warmhouse border, with good drainage and shallow soil, as some of these Macleanias have thick, fleshy roots and the fibrous roots are said to keep near the surface.

MACLÙRA, or OSAGE ORANGE. See *Toxylon.*

M'MAHON, BERNARD (about 1775 to September 16, 1816), horticulturist, was born in Ireland and came to America, for political reasons, in 1796. He settled in Philadelphia, where he engaged in the seed and nursery business. He early began the collection and exportation of seeds of American plants. In 1804 he published a catalogue of such seeds, comprising about 1,000 species. He was the means of making many of our native plants known in Europe. He enjoyed the friendship of Jefferson and other distinguished men, and his seed store became a meeting place of botanists and horticulturists. He was interested in all branches of horticulture. It is thought that the Lewis & Clark expedition was planned at his house. At all events, M'Mahon and Landreth were instrumental in distributing the seeds which those explorers collected (see p. 767). In 1806, he gave to America its first great horticultural book, "American Gardener's Calendar" (see p. 760), which was long a standard cyclopedic work. The editor of the eleventh edition of this book (1857) makes the following reminiscence of M'Mahon:

"Bernard M'Mahon was no common man. He sought the American shores from political motives, as is understood, but what these were has not been determined; most probably it was necessary to fly from the persecution of government. He found American gardening in its infancy, and immediately set himself vigorously to work to introduce a love of flowers and fruit. The writer well remembers his store, his garden and greenhouses. The latter were situated near the Germantown turnpike, between Philadelphia and Nicetown, whence emanated the rarer flowers and novelties, such as could be collected in the early part of the present century, and where were performed, to the astonishment of the amateurs of that day, successful feats of horticulture that were but too rarely imitated. His store was on Second street, below Market, on the east side. Many must still be alive who recollect its bulk window, ornamented with tulip-glasses, a large pumpkin, and a basket or two of bulbous roots; behind the counter officiated Mrs. M'Mahon, with some considerable Irish accent, but a most amiable and excellent disposition, and withal, an able saleswoman. Mr. M'Mahon was also much in the store, putting up seeds for transmission to all parts of this country and Europe, writing his book, or attending to his correspondence, and in one corner was a shelf containing a few botanical or gardening books, for which there was then a very small demand; another contained the few garden implements, such as knives and trimming scissors; a barrel of peas and a bag of seedling potatoes, an onion receptacle, a few chairs, and the room partly lined with drawers containing seeds, constituted the apparent stock in trade of what was one of the greatest seed stores then known in the Union, and where was transacted a considerable business for that day. Such a store would naturally attract the botanist as well as the gardener, and it was the frequent lounge of both classes, who ever found in the proprietors ready listeners, as well as conversers; in the latter particular they were rather remarkable, and here you would see Nuttall, Baldwin, Darlington, and other scientific men, who sought information or were ready to impart it."

1343. Madia elegans. (See p. 964.)

M'Mahon's name was given to west-coast evergreen barberries by Nuttall in 1818, and these shrubs are still known as Mahonias to horticulturists, although united with Berberis by botanists.
L. H. B.

MACODES (from *makos*, length; on account of the long labellum). *Orchidàceæ.* Contains but 2 or 3 species of the habit of Anœctochilus, which see for culture. Sepals and narrower petals spreading: labellum ventricose, with 2 small lateral lobes and 2 calli inside, turned to one side: column short, twisted in the opposite direction, with 2 narrow, erect appendages. Terrestrial herbs, with few variegated petioled lvs. at the base, and small fls. borne in a long raceme.

Pétola, Lindl. (*Anæctochilus Veitchiànus,* Hort.). Fls. greenish, inconspicuous: lvs. ovate, 2–3 in. long, reticulated with golden yellow veins. Java. R.B. 21:61.

HEINRICH HASSELBRING.

MACROCHÓRDIUM strictum, Beer, once advertised by Pitcher & Manda, is referred by Mez to *Æchmea bromeliæfolia,* Baker. See p. 28, Vol. I. It is *Bromelia melanantha,* Ker-Gawl, B. R. 9:766. The species is characterized by white-scurfy lvs., simple dense, woolly spikes overtopping the foliage: fls. with yellowish green calyx and small exserted purple-black petals. S. Amer.

MACROSCÈPIS (Greek, *macros,* long; *skepo,* to cover). *Asclepiadàceæ.* A genus of about 8 species of tall, tropical American climbers, of which **M. elliptica,** Hort. Sander, was int. in 1899. Sander & Co. describe it as "a new climbing stove-plant, with elliptic, light green leaves, which, together with the stems, are densely covered with soft, felt-like, yellow-brown hairs. The fls. are in clusters, each flower about 1 in. in diam., resembling in shape those of *Hoya carnosa,* and borne in similar bunches; they are of a soft, velvety, rich brown color. Every part of the plant, when bruised or pressed, is strongly odorous."

Generic characters are: lvs. opposite, large, cordate: cymes crowded: fls. white; calyx about 5-parted; corolla tube thick; limb spreading: scales of the crown 5, inflexed under the throat of the fleshy corolla.

MACROTÒMIA. Consult *Arnebia.*

MACROZÀMIA (Greek, *long Zamia*). *Cycadàceæ.* About 5–7 Australian cycads, which, like most of the members of this order, make noble foliage plants for private conservatories. They have the trunk and lvs. of Cycas, except that the pinnæ have no midrib but are more or less distinctly striate, especially on the under side, with several parallel equal veins, the whole leaf occasionally twisted in some species, but not constantly so in any one.

The genus is more nearly allied to Dioon and Encephalartos, from which it is distinguished by the following characters: lvs. pinnate: scales of the female cones peltate, the shield thickened, ascending, usually produced into an erect, acuminate blade. Botanically the group is very imperfectly understood. The writer has followed Bentham's account in Flora Australiensis 6:250 (1873).

Macrozamias are representative rather than useful subjects, and not frequently seen. They combine poorly in any scheme of plant and flower decoration; but as single specimens, they always attract attention, and in a grouping of similar subjects, or with aloes, agave and yuccas they make an effective combination. Their culture is easy. Sandy soil, with charcoal to keep the soil sweet, ordinary greenhouse temperature, plenty of water during the growing season, which corresponds to our summer, and rest in winter, are the essentials.

At present *M. spiralis* is the only name in American trade catalogues, but the other kinds were offered in 1893 and 1895 by John Saul, and Pitcher & Manda.

A. *Pinnæ very narrow, often nearly terete: cones small, rarely above 4 in.: fr. very woolly.*

Paulo-Guilliélmi, Hill & Muell. (*M. plumòsa,* A. Mohr.). Trunk short: lvs. 1–3 ft. long. R.H. 1877, p. 254.

AA. *Pinnæ flat, inserted on the margins of the rachis, contracted at the base: cones 4–10 in., glabrous.*

B. *Rachis of lvs. usually raised longitudinally between the pinnæ: cone scales much flattened.*

spiràlis, Miq. Trunk short: lvs. 2–4 ft. long: insertion of the pinnæ mostly longitudinal: points of the scales usually short. G.C. III. 13:74.—*M. cylindrica,* C. Moore, is a distinct species according to Index Kewensis, but Bentham considered it a doubtful variety of *M. spiralis,* being smaller, with the narrow foliage nearly of *M. Paulo-Guilielmi,* but with a glabrous trunk and more terete rachis.

BB. *Rachis of lvs. very flat between the pinnæ and often broad: cone scales very thick.*

Miquélii, DC. Cult. abroad. John Saul advertised *M. Macqui,* presumably a typographical error either for *M. Miquelii* or else *M. Macleayi,* Miq., which = *M. spiralis.*

AAA. *Pinnæ inserted by their broad base along the center of the upper surface of the rachis, scarcely separated by a very narrow line: cones large, pubescent, the scale points broad and often recurved.*

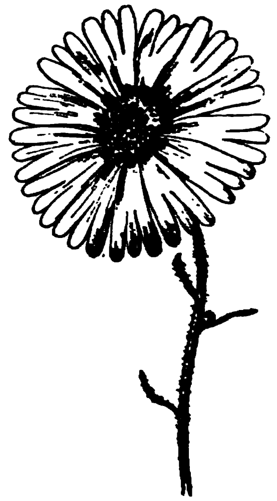
Peroffskyàna, Miq. (*M. Perowskiàna,* F. Muell.). Largest and most distinct: trunk 18–20 ft. high: lvs. 7–12 ft. long.

T. D. HATFIELD and W. M.

MADDER. The root of *Rubia tinctorum.*

MADEIRA VINE is *Boussingaultia.*

MÀDIA (*Madi,* the Chilean name of the common species). *Compósitæ.* Nine species of yellow-fld. herbs confined to the western part of the American continent. Their fls. are remarkable for closing in the sunshine, and opening in the morning or evening. They are all called Tarweeds from their glandular, viscid, heavily-scented foliage, the common Tarweed of Calif. being var. *congesta* of *M. sativa,* which is a useful annual plant for sheep pastures in dry, warm soil. *M. elegans* is an ornamental annual which every one should try. It has a graceful open habit (see Fig. 1343) and distinct fls. (Fig. 1344), which become more numerous as the summer advances. The nearest genus of garden value is Layia, from which Madia is distinguished by the following characters: involucre deeply sulcate, bracts strongly involving the akenes of the rays: akenes of the disk fertile or sterile.



1344. Madia elegans. Natural size.

A. *Rays showy.*

B. *Plant annual: lvs. chiefly alternate: pappus none.*

élegans, D. Don. Figs. 1343–4. Height 1–2 ft.: lvs. linear or lanceolate, mostly entire: rays acutely 3-lobed, yellow throughout or with a brown spot at the base. Ore. to Nev. B.M. 3548. B.R. 17:1458.—Needs a shady place.

BB. *Plant perennial: lvs. mostly opposite: pappus present in disk fls.*

Núttallii, Gray. Height 1–2 ft.: lvs. linear-lanceolate, sometimes dentate. Woods, B.C. to Monterey, Calif. —Adv. 1881 by E. Gillett. Procurable from Californian collectors.

AA. *Rays inconspicuous, about 2 lines long.*

sativa, Molina. Height 1–3 ft.: lvs. from broadly lanceolate to linear: rays 5–12. Ore., Calif., Chile.

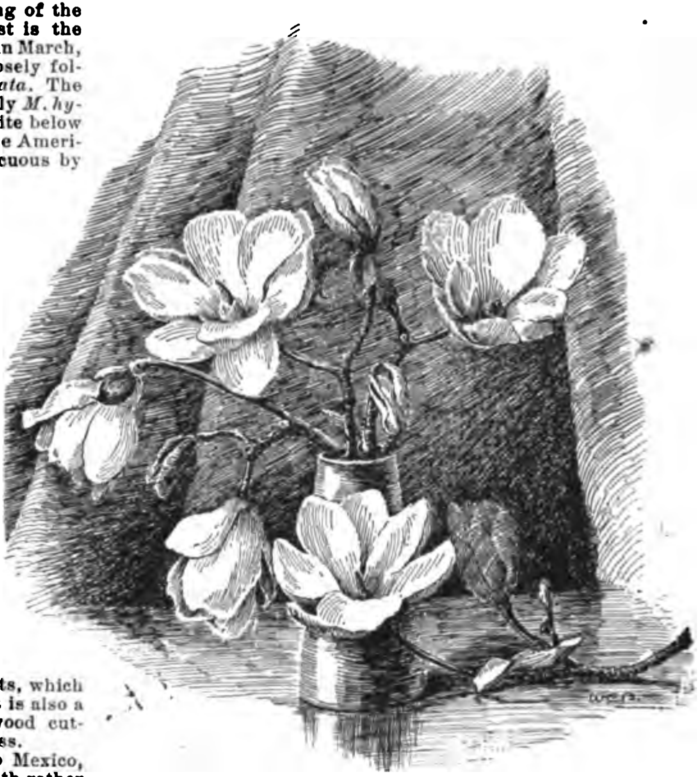
W. M.

MAGNÒLIA (after Pierre Magnol, professor of medicine and director of the botanic garden at Montpellier, 1638–1715). *Magnoliàceæ.* Highly ornamental and popular deciduous or evergreen trees or shrubs, with alternate large, entire leaves and large white, pink or purple, rarely yellowish flowers, often fragrant; the cone-shaped fruits are often pink or scarlet and very decorative. Most of the deciduous species are fairly hardy, at least in sheltered positions, as far north as northern N.Y. and Mass., and *M. acuminata*, *Kobus* and *stellata* even farther north, while *M. Campbelli* is the most tender. Of the evergreen species, *M. grandiflora*, one of the most beautiful native trees, is precariously hardy north to Philadelphia. The Asiatic deciduous species are among the most showy and striking of the early-flowering trees and shrubs; the earliest is the shrubby *M. stellata*, blooming in mild climates in March, and after this *M. Yulan* comes in bloom, closely followed by *M. Soulangeana* and after this *M. obovata*. The handsomest of the deciduous species is probably *M. hypoleuca*, with the very large leaves silvery white below and with showy, sweet-scented flowers; also the American *M. macrophylla* and *tripetala* are conspicuous by their very large foliage. The Magnolias are usually planted as single specimens on the lawn, and there are, perhaps, no plants more striking against a background of dark green conifers. Some species, as *M. grandiflora* in the South and *M. acuminata* farther north, are fine avenue trees. The Magnolias thrive best in somewhat rich, moderately moist and porous soil, preferring sandy or peaty loam, but some kinds which usually grow naturally on the borders of swamps, as *M. glauca*, thrive as well in moist and swampy situations. Transplanting is difficult and is most successfully performed just when the new growth is starting. Prop. by seeds sown immediately or stratified, and by layers of last year's growth put down in spring and tongued or notched. Layers are usually severed and transplanted the following spring, but as many of them die after transplanting, it is a safer way to take them off early in July, when the new growth has ripened, plant them in pots and keep in a close frame until they are established. Varieties and rarer kinds are often veneer- or side-grafted in early spring or summer on potted stock in the greenhouse or frame; as a stock *M. tripetala* is perhaps the best, on account of its better fibrous roots, which render transplanting safer, but *M. acuminata* is also a good stock Sometimes increased by greenwood cuttings taken with a heel and handled under glass.

About 20 species in N. America, south to Mexico, Himalayas and E. Asia. Trees and shrubs, with rather stout branches marked with conspicuous leaf-scars; stipules usually adnate to the petiole and inclosing the young successive leaf: fls. terminal, solitary, the buds inclosed in a stipular spathe; sepals 3, often petaloid; petals 6–15; stamens and carpels numerous, the latter connate into a spindle, developing into a cone-like somewhat fleshy or leathery fr., with dehiscent, 1-2-seeded carpels; the large, usually scarlet seeds often suspended for a time from the fr. by thin threads. The wood is close-grained, usually light and satiny, but not durable; that of *M. hypoleuca* is much used in Japan for laquered ware: the bark and fr. of some species have been used medicinally as a tonic and stimulant.

Alfred Rehder.

Among the finest Magnolias cultivated in the South are the two native evergreen species *M. grandiflora* and *M. glauca*, and the exotics *M. pumila* and *fuscata*, the last being now referred to Michelia. *Magnolia grandiflora* is a noble tree. It is a native of the middle and southern sections of Georgia, South Carolina, Alabama, Louisiana and the upper districts of Florida, and is recognized as one of the grandest of all broad-leaved evergreen trees. In its native habitat it attains a height of from 75 to 100 feet, with very large, oval or lanceolate coriaceous leaves. The latter vary, however, from very broad to rather narrow, some with a rusty under surface, others quite smooth. The flowers vary also in size, the largest frequently measuring 10–12 in. in diameter when fully expanded; others do not attain more than half that size. They appear early in May, in some sections during the latter part of April, and continue until the end of June. Some trees produce a few flowers during August, and even as late as October, but these are exceptions. Each flower lasts from 2-4 days, when the petals fall and the cone-like fruit appears. This gradually increases in size until September, when the bright coral-red seeds are detached and hang on long filaments. The seed should be gathered when fully ripe, put in dry sand until February in the S., then in moist sand for a week or 10 days, when the resinous cuticle can be removed by washing. Sow the cleaned seed in a box or coldframe, and as the plants show their second leaves pot off in small pots. In July, give a larger-sized pot, and the plants will be sufficiently large to plant in permanent place during the following autumn or winter. It is always advisable to take pot-grown plants, as they succeed better than plants taken up with bare roots. Magnolias are voracious feeders, and require rich soil and an abundance of plant-food. Their roots extend to a great length, and to bring out the stately beauty of this tree they should be given ample space. The wood is white, and valued for cabinet work. There are many forms cultivated in European nurseries, their main characteristics being in the size and form of the leaves and size of flowers. They are propagated by grafting, either by inarching or cleft- or tongue-graft. The latter should be done under glass, taking 2-year-old pot-grown seedlings. The fragrance of the flowers varies also, some flowers being more pungent than others, but, as a rule, the fragrance is pleasant. The principal varieties are *M. grandiflora* var. *gloriosa*, with fls. often measuring 14 in. in diameter; foliage broad and massive, brown on under surface. Seldom grows beyond 18–25 ft. Var. *præcox*, or early-flowering. Var. *rotundifolia*, with very dark green roundish lvs., rusty underneath.



1345. Magnolia Yulan (× ⅙).
Commonly known as *M. conspicua*.

Magnolia glauca, the Sweet Bay, is an evergreen tree in the southern states, becoming deciduous northward. It attains a height of 30 ft. in rich bottoms or swampy lands: lvs. oval, long or elliptical, with a glaucous under surface: fls. white, 3–4 in. in diameter, very fragrant, and produced from May to July. This tree is not sufficiently appreciated as an ornamental one in landscape gardening.

Magnolia pumila, or *Talauma pumila*, is a very dwarf Chinese species, seldom growing more than 4 or 5 ft. high: lvs. smooth, elliptical, sharp-pointed, coriaceous: fls. 1-1½ in. in diameter, white or slightly tinged green, with 6-9 fleshy petals, which drop soon after the fls. expand. The fragrance is intense at night, and resembles a ripe pineapple. It thrives best in a rich, partially shaded soil, but a frost of 10° below the freezing point will injure it. It is therefore best to grow it as a conservatory plant. Prop. by ripened wood cuttings in bottom heat. As this plant is in bloom during nearly the whole year, and its delicate fragrance is unsurpassed, it is strange that it is so little known.

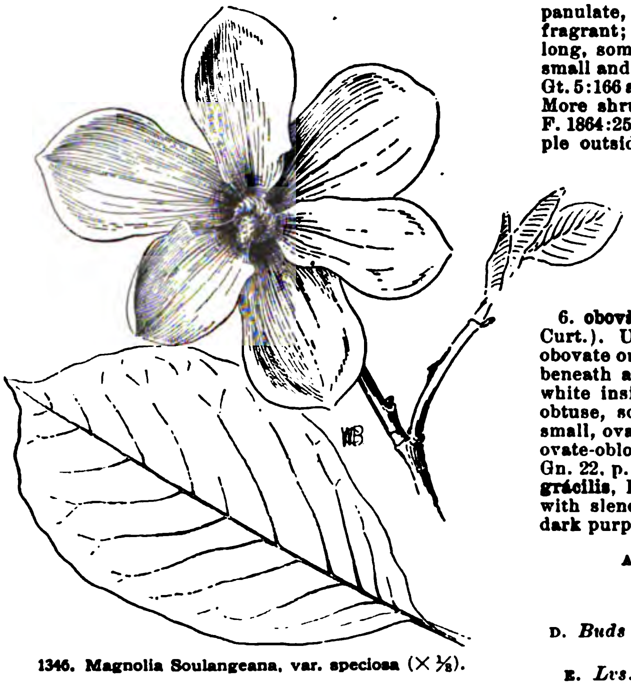
P. J. BERCKMANS.

INDEX.

acuminata, 13, 14.
angustifolia, 18.
auriculata, 11.
Alexandrina, 5.
Campbelli, 2.
conspicua, 3.
cordata, 14.
discolor, 6.
Exoniensis, 18.
fœtida, 18.
Fraseri, 11.
Galissoniensis, 18.
glauca. 15, 16.
gracilis, 6.
grandiflora, 18.
grandis, 5.
Halleana, 1.
hypoleuca, 9.
Kobus, 4.
lanceolata, 18.
Lennei, 5.
longifolia, 16.
macrophylla, 12.
major, 15.
Norbertiana, 5.
nigra, 5.
obovata, 5, 6.
parviflora, 7, 8.
pumila, 17.
purpurea, 6.
pyramidata, 11.
rosea, 1.
salicifolia, 18.
Soulangeana, 5.
speciosa, 5.
stellata, 1.
Talauma, 17.
Thompsoniana, 15.
Thurberi, 4.
tripetala, 10.
Umbrella, 10.
Virginiana, 16.
Watsoni, 8.
Yulan, 3.

A. *Blossoms appearing before the lvs.*

B. *Petals 9–18.*



1346. Magnolia Soulangeana, var. speciosa (× ⅓).

1. **stellàta**, Maxim. (*M. Halleàna*, Hort.). Shrub or small tree, with spreading branches: lvs. elliptic or obovate to oblong-obovate, obtusely pointed, pubescent beneath when young, 2–5 in. long: fls. white, short-stalked, numerous, about 3 in. across, sweet-scented; petals narrow-oblong, 9–18, spreading and afterwards reflexed: fr. with only few carpels ripening. March, April. Japan. B.M. 6370. R.H. 1878:270. Gn. 13:132. G.F. 9:195. G.C. III. 7:617 and 17:521. Gng. 2:57. A.F. 6:305. F.E. 9:611. G.M. 38:489. F.M. 1878:309.—Quite hardy and very free-flowering; it begins to flower when hardly 2 ft. high. Var. **ròsea**, Hort., has the fls. blushed outside.

2. **Cámpbelli**, Hook. f. & Thoms. Tree, to 80 ft.: lvs. elliptic-oblong or ovate, abruptly acuminate, glaucous beneath and silky pubescent when young, 5–12 in. long: fls. cup-shaped, 6–10 in. across, white inside and pink, shaded with crimson, outside; petals obovate, 9–15: fr. greenish brown, 6–8 in. long. May. Himalayas. B. M. 6793. F.S. 12:1282–85. Gn. 48:1028; 53, pp. 167, 305. G.C. III. 23:89.—Beautiful tree, hardy only South.

BB. *Petals 6–9.*

C. *Fls. pure white.*

3. **Yùlan**, Desf. (*M. conspicua*, Salisb.). Fig. 1345. Tree, to 50 ft., with spreading branches: lvs. obovate or obovate-oblong, shortly pointed, pubescent beneath when young, 4–7 in. long: fls. large, campanulate, sweet-scented, about 6 in. across; petals and sepals almost alike, 9, concave, fleshy, 3–4 in. long: fr. brownish, 3–4 in. long, slender. April, May. Japan, China. B.M. 1621. L.B.C. 12:1187. G.C. III. 9:591. Gn. 21, p. 311; 23, p. 138; 24, p. 511; 31, p. 505; 34:667; 45, p. 365; 46, p. 145; 51, p. 474. G. M. 31:289; 36:386.—One of the most showy species.

4. **Kòbus**, Thunb. (*M. Thùrberi*, Hort.). Tree, to 80 ft., with narrow pyramidal head: branches short and slender: lvs. broadly obovate, abruptly pointed, tapering toward the base, pubescent below at first, 3½–6 in. long: fls. 4–5 in. across; sepals very small and narrow; petals 6, spreading, thin, 2–2½ in. long: fr. slender, dark brown, 4–5 in. long. April, May. Japan. G. F. 6:66.—One of the hardiest species but less showy; seems not to flower very profusely.

CC. *Fls. purplish or carmine outside.*

5. **Soulangeàna**, Soul. (*M. obovàta* × *Yùlan*). Intermediate between the parents. Popular large shrub or small tree: lvs. obovate to obovate-oblong: fls. large, campanulate, white, more or less purplish outside, often fragrant; sepals usually colored, sometimes almost as long, sometimes hardly half as long as petals, rarely small and greenish. May. A. G. 15:283. B. R. 14:1164. Gt. 5:166 and 168. S.B.F.G. I. 3:260. Var. **Lennéi**, Hort. More shrubby: fls. large, deep crimson outside, late. F. 1864:25. V. 5:196. Var. **nigra**, Hort. Fls. dark purple outside. There are many other named vars., like var. **Alexandrina**, **grándis**, **Norbertiàna**, **speciosa** (Fig. 1346), differing but little in color and flowering time, var. *Alexandrina* being one of the earliest, var. *Norbertiana* one of the latest in bloom. These hybrids are among the most popular Magnolias on account of their early, bright-colored fls.; they are showier and hardier than the following species.

6. **obovàta**, Thunb. (*M. discolor*, Vent. *M. purpùrea*, Curt.). Usually large shrub, with stout branches: lvs. obovate or oval-obovate, acute or acuminate, pubescent beneath at first, 4–7 in. long: fls. large, campanulate, white inside, purple outside, scentless; petals broad, obtuse, somewhat fleshy, about 3½ in. long; sepals small, ovate-lanceolate, greenish yellow: fr. brownish, ovate-oblong. May, June. China, Japan. B. M. 390. Gn. 22, p. 485; 24, p. 511; 46, p. 49. F. E. 9:611. Var. **grácilis**, Dipp. (*M. grácilis*, Salisb.).—Smaller shrub, with slender branches, narrower lvs. and smaller fls., dark purple outside.

AA. *Blossoms appearing after the lvs.*

B. *Foliage deciduous.*

C. *Fls. white.*

D. *Buds and branchlets glabrous or appressed pubescent: carpels glabrous.*

E. *Lvs. 4–7 in. long, scattered along the branches.*

7. **parviflòra**, Sieb. & Zucc. Small tree: branchlets and buds appressed pubescent: lvs. elliptic to obovate-oblong, obtusely pointed, glaucescent beneath and pubescent at first, 4–6 in. long: fls. long-pedicelled, cup-shaped, white, with large pink sepals, 3–4 in. across, fragrant; petals usually 6; stamens crimson; carpels few. June. Japan. B.M. 7411. Gn. 54, p. 177. Gng. 1:8; 3:3. G.M. 38:66.

8. **Wátsoni,** Hook. Closely allied to the former: almost glabrous, except lvs. beneath when young: lvs. obovate to oblong, 4–7 in. long: fls. short-stalked, 5–6 in. across, with 6–9 petals; carpels many. June. Japan. B.M. 7157. G.C. III. 16:189 and 17:517. Gt. 48:1459. Gng. 1:8. Gn. 24:417 (as *M. parviflora*) probably belongs here. G.M. 34:305.—Very handsome in bloom; the beauty of the large, sweet-scented flower is much heightened by the crimson center, formed by the bright-colored stamens.

EE. *Lvs. 8–20 in. long, mostly clustered at the end of the branches: buds and branches glabrous.*

9. **hypoleùca,** Sieb. & Zucc. Tree, to 100 ft. high, with broad, pyramidal head: lvs. obovate to obovate-oblong, obtusely pointed, glaucous and appressed pubescent beneath, 8–14 in. long: fls. 6–7 in. across, cup-shaped, fragrant, with 6–9 petals; stamens with scarlet filaments: fr. oblong-cylindric, scarlet, to 8 in. long. May, June. Japan. G.F. 1:305. Gng. 1:8. Mn. 3, p. 73.—One of the most beautiful of the deciduous species, the under side of the lvs. being almost silvery white; about as hardy as *M. macrophylla.*

10. **tripétala,** Linn. (*M. Umbrélla,* Lam.). UMBRELLA TREE. Tree, to 40 ft., with spreading branches, forming an open head: lvs. tapering toward the base, oblong-obovate, acute, pale and pubescent beneath when young, 12–24 in. long: fls. 8–10 in. across, of a disagreeable odor; petals 6–9, oblong-obovate, 4–5 in. long; sepals recurved, light green: fr. rose-colored, ovate-oblong, 2½–4 in. long. May. Pa. to Ala., west to Ark. and Miss. S.S. 1:9 and 10. Gn. 22, p. 27; 24, p. 509; 33, p. 539.

11. **Fràseri,** Walt. (*M. auriculàta,* Lam. *M. pyramidàta,* Pursh). Tree, to 40 ft., with wide-spreading branches, quite glabrous: lvs. obovate, cordate-auriculate at the base, acute, glaucescent beneath, 8–20 in. long: fls. 6–9 in. across, sweet-scented; petals 6–9, oblong-obovate, 4–5 in. long: fr. oblong, bright rose-red, 3–5 in. long. Va. to Fla., west to Miss. S.S. 1:11 and 12. B.M. 1206. B.R. 5:407. L.B.C. 11:1092. Gn. 22:27; 24, p. 511; 44, p. 935.

DD. *Buds and branches grayish tomentose: carpels woolly.*

12. **macrophýlla,** Michx. LARGE-LEAVED CUCUMBER TREE. Tree, to 50 ft., with spreading branches: lvs. oblong-obovate, blunt, subcordate-auriculate at the base, glaucescent and finely pubescent beneath, 1–3 ft. long: fls. cup-shaped, fragrant, 10–12 in. across; petals 6, oblong-obovate, thick, purplish at the base, 6–7 in. long: fr. broadly ovate, rose-colored, to 3 in. long. May, June. Ky. to Fla., west to Ark. and La. S.S. 1:7 and 8. B.M. 2981. G.F. 8:165. Gn. 22, p. 28; 24, p. 509; 33, p. 539.

CC. *Fls. yellow or greenish: petals 6, 2–3½ in. long.*

13. **acuminàta,** Linn. CUCUMBER TREE. Tall, pyramidal tree, to 90 ft.: lvs. oval to oblong, shortly acuminate, rounded or acute at the base, soft pubescent and light green beneath, 6–9 in. long: fls. greenish yellow or glaucous green, about 2–3½ in. high, with upright petals: fr. cylindric, pink, 3–4 in. long. May, June. N. Y. to Ga., west to Ill. and Ark. S.S. 1:4 and 5. B.M. 2427. L.B.C. 5:418. Gn. 24, p. 509.

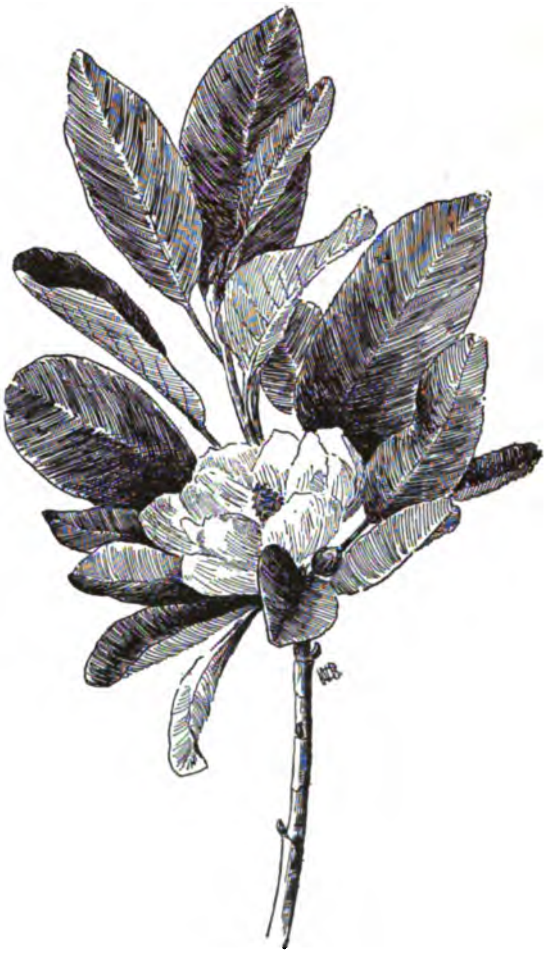
14. **cordàta,** Michx. (*M. acuminàta,* var. *cordàta,* Sarg.). Similar to the former, but smaller: lvs. more pubescent, oval to ovate, acute, rounded or sometimes slightly cordate at the base: fls. smaller, canary yellow. Ga. and Ala. S.S. 1:6. B.M. 2427. L.B.C. 5:474. Gn. 22, p. 27; 24, p. 509.

BB. *Foliage coriaceous, persistent, but deciduous North in Nos. 15 and 16.*

C. *Lvs. glabrous or silky-pubescent beneath: usually shrubby.*

15. **Thompsoniàna,** Hort. (*M. glaùca,* var. *màjor,* Sims. *M. glaùca,* var. *Thompsoniàna,* Loud.). Probable hybrid of *M. glauca* and *tripetala.* Shrub or small tree: branches and buds glabrous: lvs. oval to oblong, acute, glaucescent beneath and pubescent when young, 5–9 in. long: fls. white, fragrant, 5–6 in. across; sepals shorter than the petals, yellowish. June, July. G. F. 1:269. B.M. 2164. Gn. 24, p. 511.—Of garden origin.

16. **glaùca,** Linn. (*M. Virginiàna,* Morong). SWEET, SWAMP OR WHITE BAY. BEAVER TREE. Fig. 1347. Attractive shrub or small tree, evergreen South: lvs. oval to oblong-lanceolate, glaucous beneath and silky-pubescent at first, 3–6 in. long: fls. white, globose, fragrant, 2–3 in. across; sepals nearly as large as petals, spreading; petals 9–12, roundish obovate: fr. pink, 1–2 in. long. May, June. Mass. to Fla. near the coast, in the South extending west to Texas. S.S. 1:3. Em. 2:603. L.B.C. 3:215. R.H. 1894, p. 347. G.F. 10:403. Gng. 4:342.—A very desirable shrub, with handsome, glossy foliage and sweet-scented, creamy white fls. Var. **longifòlia,** Loud., has lanceolate lvs. and continues blooming during a longer time than the type.



1347. Magnolia glauca (× ⅓).

17. **pùmila,** Andr. (*Talaùma pùmila,* Blume). Shrub, to 12 ft.: lvs. elliptic-oblong, acuminate, glabrous, glaucescent beneath, 3–6 in. long: fls. axillary, nodding on short-curved pedicels, globose-ovate, white, fragrant, about 1¼ in. across; petals 6. China. B.M. 977.—Cult. South.

CC. *Lvs. ferrugineous, pubescent beneath: tree.*

18. **grandiflòra,** Linn. (*M. fœtida,* Sarg.). BULL BAY. Tall evergreen tree, to 80 ft., of pyramidal habit: branchlets and buds rusty-pubescent: lvs. thick and firm, oblong to obovate, glossy above, ferrugineous-pubescent beneath, sometimes glabrous at length, 5–8 in. long: fls. white, fragrant, 7–8 in. across; sepals large, petaloid; petals 6–12, obovate; stamens purple: fr. oval

or ovate, rusty brown and pubescent, 3-4 in. long. May-Aug. N. C. to Tex. S.S. 1:1 and 2.—Var. **angustifòlia,** Loud. (var. *salicifòlia,* Hort.). Lvs. lanceolate, wavy. Var. **lanceolata,** Ait. (var. *Exoniénsis,* Loud.). Lvs. oblong-lanceolate or oblong-elliptic, less rusty beneath. B.M. 1952. L.B.C. 9:814. There are many other named varieties, of which var. **Galissoniénsis,** Hort., has proved the hardiest in Europe. For other pictures, see Gn. 22, p. 28; 24, pp. 509, 511; 33, p. 538.

M. comprèssa, Maxim. =Michelia compressa.—*M. fuscàta,* Andr.=Michelia fuscata.—*M. salicifòlia,* Maxim. Small, deciduous tree: lvs. elliptic to ovate-lanceolate, glaucous beneath, 4-7 in. long: fls. unknown. Japan. G.F. 6:67.

ALFRED REHDER.

MAHÉRNIA (anagram of *Hermannia*). *Sterculiàceæ.* More than 30 herbs and subshrubs of S. Africa, mostly with incised lvs. and drooping, bell-shaped fls. Calyx campanulate, 5-cleft; petals 5, with hollow claws, twisted in the bud; stamens 5, opposite the petals, the filaments prominently enlarged or dilated at about the middle (and thus differing from Hermannia, which has no sudden enlargement in the filaments), the anthers long: ovary 5-loculed, ripening into a coriaceous capsule with many seeds. Monogr. in Harvey and Sonder's Flora Capensis. By some the genus is united with Hermannia. A few of the Mahernias are cult. as pot-plants for the profusion of their bell-like fls. and the sweet odor.

1348. Mahernia verticillata. (×½.)

verticillàta, Linn. (*M. odoràta,* Hort, not of botanists, which is *Hermannia Presliana*). HONEY BELL. Fig. 1348. Very common plant in conservatories, and sometimes seen in window-gardens (see *House Plants*): half woody, very diffuse and straggly, not making a central leader, the terete crooked stems scabrous: lvs. small, much cut into linear divisions, with deep cut stipules: fls. ¾ in. or less long, nodding, usually about 2 together, from axillary shoots, sweet, fragrant, honey-yellow.—Free bloomer in winter and spring. Of easy cult. Prop. by cuttings. *Mahernia verticillata* is a very pretty twiggy bush for the cool greenhouse. The branches are long and flexible, so that specimens may be trained into any form. It may also be used for hanging baskets. It is of easy culture in pots, but lifts badly.

glabràta, Cav. Lvs. dentate or dentate-pinnatifid (not so finely cut as in the last), covered with stellate down: trailing.—It is doubtful if the plant cult. under this name is the *M. glabrata* of botanists.

L. H. B.

MAHOE, MOUNTAIN. See *Hibiscus elatus.*

MAHOGANY. See *Swietenia.* **Mountain Mahogany.** See *Cercocarpus.*

MAHÒNIA. Included with *Berberis.*

MAIDENHAIR FERN is *Adiantum.*

MAIDENHAIR TREE. See *Ginkgo.*

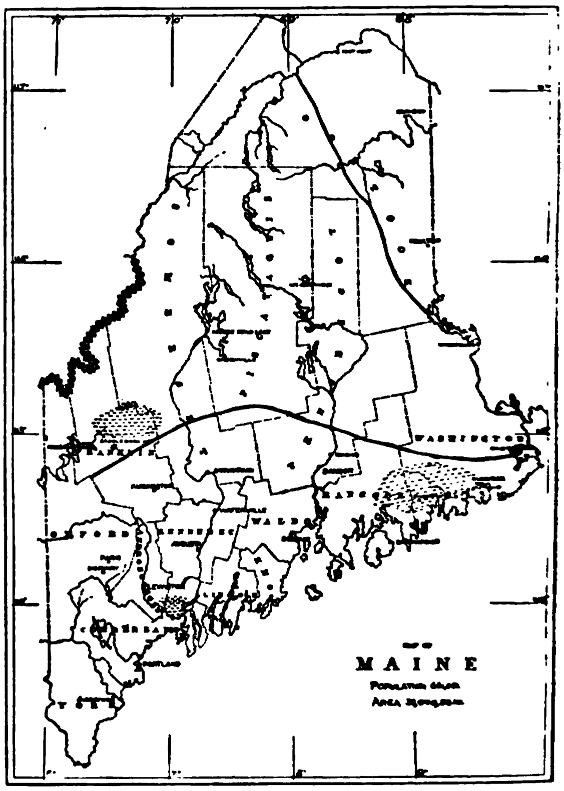
MAIÁNTHEMUM (Greek, *May flower*). *Liliàceæ.* **M. Convallária,** Weber, is a pretty little native wild flower growing 3-5 inches high, with 1-3 heart-shaped shining lvs., and a raceme about 1 in. long of small white fls., with 4-parted perianth and 4 stamens. It grows in moist woods, and is fully described in our manuals. It has been offered by dealers in native plants under its synonyms, *M. bifolium, Canadense* and *Smilacina bifolia.* B.B. 1:431. B.M. 510. It is sometimes called False Lily-of-the-Valley or Two-Leaved Solomon's Seal. Foliage dies in midsummer. Useful for early effects.

MAINE, HORTICULTURE IN. Fig. 1349. **Maine,** the most northeasterly of the United States, lies between latitudes 46° 6′ and 47° 27′ north and longitudes 66° 56′ and 71° 26′ west. The name was used by early explorers to designate the mainland as distinct from the numerous islands along the coast. Although its extreme breadth from east to west is but 270 miles, its coast line is so broken as to extend for 2,486 miles along the Atlantic. The total area of the state is 33,000 square miles, of which 3,145 is water surface. The surface of the state is disposed in two great slopes, separated by a broad plain from 1,000 to 2,000 feet above the sea (see the map). This plain, the eastern end of the Appalachian range, contains numerous hills and mountains, the highest of which is Mt. Katahdin, with an altitude of 5,385 feet.

The slopes are much broken by hills and lakes, and vast areas are still covered by the primeval forest. There is thus provided a wide diversity of soil and climatic conditions in different parts of the state, which affords opportunity for a considerable range in agricultural productions. Under these conditions, even from the earliest settlement of the state, agriculture has received a fair share of attention. There were in 1892 65,000 farms, containing 6,500,000 acres, representing a cash value of $102,500,000, and an estimated value of farm products of $22,000,000.

The forests, located mainly in the middle belt, form one of Maine's principal sources of wealth. In the northern part these consist chiefly of pine, spruce, hemlock and arborvitæ. Farther south, in addition to the conifers, red oak, beech, birch, maple, ash and elm abound. Butternut and hickory are found, but are not abundant. The productions for which the state is especially noted, aside from lumber, are hay, potatoes, sweet corn and fruit. Of the first, from 1,500,000 to 2,000,000 tons are cut each year.

Potatoes form the staple crop in Aroostook county—the "Garden of Maine"—though many thousand bushels are grown in the southern counties. The annual crop is



1349. Maine. To illustrate its horticulture.

not far from 10,000,000 bushels. The greater portion of the potatoes grown in Aroostook county is converted into starch. The annual product of the starch factories is from 12,000,000 to 15,000,000 pounds. The average yield is about 120 bushels per acre, but as many as 500 and even 700 bushels have been obtained.

The production of sweet corn for canning has become an important industry in the southwestern and central parts of the state. The total pack in 1890 was about 12,000,000 cans, representing 3,000 acres. In 1892, 18,000,000 cans were packed, while in 1897 the output was about the same.

The rocky hillsides of southwestern Maine are especially suited for producing apples of superior color, flavor and keeping qualities. Pears and plums are also grown to a considerable extent. The value of the orchard products is about $1,500,000 annually. Desirable sites for orchards range in value from $5 to $50 per acre, according to the location and distance from shipping points.

Small fruits thrive over the greater part of the state, and find a ready market at the numerous summer resorts for which Maine is noted.

The canning of blueberries is an important industry in some parts of the state. In Washington county about 120,000 acres, otherwise worthless, are known as the "blueberry barrens." The annual output of the canning factories is valued at $75,000 to $100,000, and 1,500 or 2,000 bushels are shipped while fresh. In other parts of the state there are many thousand acres that may be utilized in the same way. Some of the more important blueberry regions are indicated by the shaded areas on the map.

In providing for education along agricultural lines, Maine has not been behind other states. While Arthur Young and others were striving to improve the agriculture of Great Britain, leading citizens of the then District of Maine united in forming one of the first agricultural societies in America. As noted by Boardman: "The light stations first established in this country for the improvement and the diffusion of agricultural literature were at Philadelphia, Pa., in 1785; Charleston, S. C., in 1785; Hallowell, Maine,1787."

The first agricultural and industrial college in North America, the Gardiner Lyceum, was established at Gardiner, Me., in 1821, when a yearly grant of $1,000 was made by the state. The purpose of the school was "to give mechanics and farmers such a scientific education as would enable them to become skilled in their professions." This institution, under the patronage of the Vaughans and the Gardiners, flourished until 1835, when state aid was withdrawn. It was continued for two years at the expense of Mr. Gardiner, and then closed. In connection with the Lyceum, a farm was utilized for experiments in agriculture, and "to give the future agriculturist the knowledge of those principles of science upon which his future success depends, and an opportunity to see them reduced to practice."

In 1865 the State College of Agriculture and the Mechanic Arts was established under the provisions of the "Morrill Act." This, in 1897, became the University of Maine, with a well-equipped agricultural department. The Maine Agricultural Experiment Station, established under the provisions of the "Hatch Act" in 1887, forms a department of the university. In addition to the work of the university, important educational work is carried on in the form of farmers' institutes by the State Board of Agriculture, consisting of one member from each county, with permanent headquarters at the capital. There are also two state agricultural societies, one state pomological society, and nearly 50 county and town agricultural societies which receive aid from the state.

W. M. MUNSON

MAIZE. See *Corn* and *Zea*.

MAKART DECORATIONS and bouquets are dried grasses and everlastings, whether dyed or not. The celebrated painter, Hans Makart, once decorated his salon with dried palm leaves, pampas grass and the like, to the delight of the Emperor of Austria, who visited the artist's studio: hence the name. See *Everlastings* and G.C. III. 6:714.

MALAY APPLE. *Eugenia Jambos*.

MALCOLMIA. See *Malcomia*.

MALCÒMIA (Wm. Malcolm, English horticulturist of the eighteenth century). Also written Malcolmia, but it was originally spelled Malcomia. *Cruciferæ*. A genus of about 20 species, one of which is called the Virginian Stock, though it is a native of the Mediterranean region. It is a charming hardy annual of the easiest culture, growing about a foot high, with a more branching and open habit than the common stock (Matthiola), and 4-petaled fls. each about ¾ in. across. Red, white and crimson-fld. kinds are offered in America, while rose and lilac fls. appear in the mixtures. There seem to be no double forms. It is an excellent plant for the front of a border, as it may be easily had in bloom from spring to fall by means of successional sowings. Seeds are best sown in the fall, as they give earlier bloom. Seeds may be sown thinly. See *Annuals*.

1350. Virginian Stock, Crimson King.

Malcomia is a genus of branching herbs: branches often prostrate: lvs. alternate, entire or pinnatifid: fls. in a loose raceme; petals long and linear or long-clawed: pods rather terete, long or awl-shaped: seeds in 1 series or in 2 series at the base of the cells.

maritima, R. Br. VIRGINIAN STOCK. MAHON STOCK. Figs. 1350, 1351. Stem erect, branching: lvs. elliptic, obtuse, entire, narrowed at the base, pubescence appressed, 2–4-parted: pedicels rather shorter than the calyx: pods pubescent, long-acuminate at the apex. B.M. 166 (as *Cheiranthus maritimus*, showing red fls., changing to purple before fading). W. M.

MALLÒTUS (Greek, *woolly*). *Euphorbiàceæ*. Trees or shrubs, with broad opposite lvs., with small diœcious fls. in spikes or panicles: petals and disk absent; calyx 3–5-lobed; stamens numerous; styles 3, almost free, recurved; capsule spherical, splitting into 3 parts. About 80 species in the Old World tropics.

Japònicus, Müll. Arg. A small tree, with large, ovate, palmately nerved, nearly glabrous, sub-trilobed, long-petioled lvs.: spikes branched terminal: fls. 2–3 lines wide; stamens 60–70, yellow; stigmas slightly feathery: capsules pubescent, ⅓ in. in diam. Japan and China. R.H. 1894, p. 103.—Cult. at Santa Barbara.

J. B. S. NORTON.

MALLOW. *Malva rotundifolia*.

MALLOW, FALSE. *Malvastrum*.

MALÒPE (name used by Pliny for some kind of mallow). *Malvàceæ*. A genus of 10 species of annuals from the Mediterranean region, one of which is cult. under the name of *M. grandiflora*. It grows 1–3 ft. high, and bears red or white, 5-petaled fls. 2½–3 in. across, in summer and fall. The genus is allied to Althæa, which it resembles in having solitary ascending ovules, but has the carpels crowded into a sort of head without order, while in Althæa the carpels are in a single whorl. Also, Malope has 3 bractlets, while Althæa has 6–9. Herbs glabrous or pilose: lvs. entire or 3-cut: fls. usually violet or rosy; bractlets large, cordate; calyx 5-cut; column of stamens divided at the top into filaments. Culture easy. See *Annuals.*

trífida, Cav. Lvs. 3-nerved, 3-cut, dentate, glabrous; lobes acuminate: peduncles axillary, 1-fld. Spain, N. Africa.—Var. **grandiflòra,** Paxt. (*M. grandiflòra*, F. G. Dietr.), is said to be much superior to the type, with fls. 2½–3 in. across, deep rosy red, veined inside darker. Gn. 21, p. 145. P.M. 1:177. *M. grandiflora alba* is also cult.

1351. Virginian Stock—Malcomia maritima. Natural size. (See p. 969.)

MALPÍGHIA (Marcello Malpighi, 1628–1693, distinguished anatomist at Boulogne, who wrote on the anatomy of plants). *Malpighiàceæ.* About 20 species of small trees or shrubs, mostly natives of tropical America, one of which is the Barbadoes Cherry, *M. glabra.* The fruit is about the size and shape of a small northern cherry, but inferior in quality. It has an acid taste. It is borne on a shrub, which grows about 6 ft. high and has handsome crimson fls. of a distinct appearance. The fl. is about ¾ in. across, and the 5 petals have a claw about as long as the fringed blade. This shrub is a native of the West Indies and is cult. in all the Islands as well as S. Amer. It is also offered in S. Fla.

Malpighias have opposite, short-stalked lvs., glabrous or tomentose, entire or spiny-toothed: fls. axillary, clustered or corymbose, rarely solitary, red, rose or white; calyx 5-parted, 6–10-glandular; stamens 10: ovary 3-celled: styles 3, distinct: drupe 3-stoned, the stones with or without 3–5 crests or wings on the back.

glàbra, Linn. Barbadoes Cherry. Lvs. ovate, glabrous, entire, usually pointed, having a few biscuspidate hairs which disappear early: umbels 3–5-fld.: calyx 6–8 glandular: stones obtusely 4-angled. B.M. 813.

W. M.

MÀLUS. See *Pyrus.*

MÀLVA (old Latin name from Greek *malache;* referring to the emollient lvs.). *Malvàceæ.* About 16 species of herbs, widely scattered, 4 of which are cult. in America and have escaped from old gardens, while one, *M. rotundifolia* (Fig. 1352), the common Mallow, is a familiar weed. These plants are of the easiest culture, and bloom all summer and fall, having pink, rose or purple fls. sometimes 2 in. across. Malva is distinguished from numerous allied genera by the carpels in a single whorl: ovules solitary, ascending: bractlets 3, distinct: carpels not beaked or appendaged within. Malvas are hirsute or nearly glabrous: lvs. angled, lobed or dissected: fls. solitary, in the axils or clustered, sessile or peduncled: petals 5, notched at the apex. In the first 2 species the pedicels are solitary in the upper axils; in the next 3 they are numerous and clustered.

A. *Fls. large and showy, 1½–2 in. across.*

B. *Fruit downy, not wrinkled.*

moschàta, Linn. Musk Mallow. Perennial, 1–2 ft. high, less hairy than *M. Alcea:* stem-lvs. 3–many times parted, the lobes being linear: fls. rose or white; calyx with long, simple hairs. Eu.; cult. and escaped. R.H. 1851:381.

BB. *Fruit glabrous, minutely wrinkled or veiny.*

Àlcea, Linn. Perennial, 2–4 ft. high: stem-lvs. parted almost to the base into 3–5 divisions, which are again 3–5-cut, the lobes broad: fls. deep rose; calyx densely stellate-pubescent. Eu.; cult. and escaped. B.M. 2297 (pink, veined deeper).—Var. **fastigiàta,** Koch (*M. Morénii*, Pollini). Lvs. less incised; upper stem-lvs. 3-fid; intermediate ones 5-fid; lobes oblong, unequally dentate. B.M. 2793.

BBB. *Fruit prominently wrinkled-veiny.*

sylvéstris, Linn. Biennial or perennial, 2–3 ft. high, rough-hairy, branching: lvs. rather sharply 5–7-lobed: fls. purple-rose. Eu., temp. Asia, waysides N. Amer. A.G. 13:471.—Not advertised. See *M. zebrina* in supplementary list. Var. **Mauritiàna** (*M. Mauritiàna*, Linn.) has long been cult. in cottage gardens abroad as the Tree Mallow. It is taller, smoother and has more obtuse lobes.

AA. *Fls. small, inconspicuous, whitish.*

B. *Lvs. curled or puckered at the margin.*

críspa, Linn. Curled Mallow. Unbranched annual, 4–6 ft. high, leafy from base to top: lvs. rounded, 5–7-lobed or angled: fls. clustered, almost sessile. Eu.; sparingly escaped from old gardens. Gn. 2, p. 315. Vilmorin's "Vegetable Garden," p. 319.—No longer advertised, but procurable abroad and still cult. in America. No part of the plant is eaten, but the elegantly crisped leaves are sometimes used for garnishing dishes. Generally self-sows in gardens.

BB. *Lvs. not curled at the margins.*

rotundifòlia, Linn. Fig. 1352. Common Mallow. Stems trailing from a strong, deep root: lvs. rounded kidney-shaped, crenate; leaf-stalks very long: peduncles rather slender.—Common biennial or perennial weed, not cult. The flat wrinkled fruits are known to children as "cheeses." Also locally called "Shirt-button plant."

1352. Malva rotundifolia (× ⅓). A common weed, known as "Cheeses."

M. miniàta is a much confused name. In the Thorburn catalogue the plant in the American trade is said to be the same as Sphæralcea Munroana, probably on the authority of E. S. Carman in A.G. 11:539. M. miniata is also advertised by German dealers and is referred by Vilmorin's Blumengärtnerei to Sphæralcea miniata. Index Kewensis, however, refers M. miniata to Sphæralcea cisplatina. This riddle will, perhaps, be solved under Sphæralcea, which see.—*M. multifida alba*, Hort., is probably a white-fld. form of one of the species above mentioned, with foliage many times divided.—*M. zebrìna*, Hort., is referred by Index Kewensis to M. sylvestris; by Vilmorin's Blumengärtnerei to M. Mauritiana. In Bridgeman's catalogue M. zebrina is described as a hardy annual, called "Striped Mallow," growing 2 ft. high, with white and purple fls. W. M.

MALVÁSTRUM (name made from Malva). *Malvàceæ.* Sixty or more herbs and subshrubs in America and S. Africa, of which 2 or 3 are plants of minor importance in gardens. From Malva and its allies it differs in having short or capitate stigmas on the style-branches rather than longitudinal stigmas, also in having a solitary ovule in each carpel. From Malvaviscus it differs in having a dry rather than a baccate fruit, and in other characters. The garden species are perennials of easy culture, blooming in the hot weather of summer.

coccíneum, Gray. A tufted canescent plant, 5–10 in. or less high, with running rootstocks: lvs. not more than 1 in. across, pedately 3–5-parted or divided, the narrow divisions again cut or cleft: fls. brick-red or coppery, in a short terminal raceme: carpels round-kidney-shaped, inclosed in the incurving calyx lobes. Western Amer. B. M. 1673 (as *Cristaria coccinea*).—There is a var. **grandiflòrum** in the trade, with "large deep scarlet fls."

campanulàtum, Nichols. Two ft. or less high, hairy: lvs. pedately 3–5-lobed, the lobes deeply cut and toothed, clasping: fls. rose-purple, an inch across. Chile. P.M. 9:173, and R.H. 1843:325 (as *Malva campanulata*).

spléndidum, Kell. Shrub, becoming 12 ft. or more, gray-tomentose: lvs. cordate-ovate, 5-lobed: fls. rosy pink, fragrant. Calif. L. H. B.

MALVAVÍSCUS (Greek, *sticky mallow*). *Malvàceæ.* About 25 species of tender shrubs from the warmer parts of America, one of which, *M. arboreus*, is known to the trade as *Achania Malvaviscus.* It is a fine old greenhouse shrub with erect scarlet fls., which resemble an Abutilon and never open widely. Abutilon, however, has no involucre, while Malvaviscus has an involucre of 10–12 bractlets. Lvs. entire, dentate, angled or lobed: fls. red, usually peduncled; petals erect and connivent or spreading in the upper half; column of stamens truncate below the apex or 5-toothed: carpels fleshy outside, connate into a berry, later separating.

1353. Malvaviscus arboreus. (×⅛.)

arbòreus, Cav. (*Achània Malvaviscus*, Sw.). Fig. 1353. Tall shrub: lvs. alternate, mostly 3-lobed, acuminate, heart-shaped at the base, toothed: fls. convolute in the bud; bractlets erect. S.Amer. B.M.2305.—Cult. outdoors in S.Fla. and S.Calif.

Malvaviscus arboreus is one of the most satisfactory house plants that can be grown. It is not subject to insects of any kind, will stand a low temperature in winter, and blooms both winter and summer. When pot grown, the plant is usually about 2 ft. high, but outdoors it makes a strong, branching growth, attaining 3–5 ft. The bright scarlet fls. remain a long time in perfect condition. The fls. open slightly at the top or not at all. This circumstance gave rise to the old name Achania, which means *not opening*. The plant needs a good light soil and thrives in a compost of fibrous peat and loam. Prop. by cuttings. The cultivators need not fear the appearance of white grains on the surface of the lvs., as they are a normal, waxy secretion of the plant.

JAMES VICK.

MAMILLARIA. See *Mammillaria.*

MAMMÈA (from a South American name). *Guttiferæ.* Six species of tropical trees, one of which, *M. Americana*, produces the fruits known as the Mammee Apple or St. Domingo Apricot. These are 3–6 in. in diameter, round, russet-colored or brown, with a yellow juicy pulp, and 1–4 large, rough seeds. The skin and seeds are bitter and resinous. The fruits are eaten raw without flavoring, or with wine and sugar, or sugar and cream. They are also preserved. The taste for them does not have to be acquired. The tree is cult. in S. Fla. and S. Calif., and a few fruits are brought from the West Indies to the U. S. The nearest ally of horticultural value is the Mangosteen, belonging to the genus Garcinia, characterized by having 4 sepals, while Mammea has a calyx which is closed before anthesis, and afterwards is valvately 2-parted. Mammeas have rigid, leathery lvs., often dotted with pellucid glands: peduncles axillary, 1-fld., solitary or clustered: fls. polygamous; petals 4–6; stamens numerous; stigma peltate or broadly lobed: ovary 2–4-celled.

Americàna, Linn. MAMMEE APPLE. ST. DOMINGO APRICOT. Fig. 1354. Tree, 40–60 ft. high: lvs. obovate-oblong, rounded at tip, 4–8 in. long: peduncles few or solitary: petals white, fragrant; anthers oblong, laterally dehiscent. B.M. 7562. W. M.

Mammea Americana is native from the West Indies to Brazil. The wood is durable and well adapted for building purposes, posts and piles. It stands damp. It is beautifully grained and is used for fancy work. The gum is applied to extract chigoes; dissolved in lime-juice it destroys maggots in sores at a single dressing. An infusion of the bark is astringent and is useful to strengthen the recent cicatrices of sores. A liqueur has been obtained by distillation from the flowers infused in spirits of wine, known in the Island of Martinique by the name of "*Creme des Creoles.*" The fruit is the size of a very large orange. It has a sweetish, somewhat aromatic taste and a peculiar odor. Not much use is made of it. Seeds germinate freely, and young plants are easily raised. W. HARRIS.

MAMMEE APPLE. See *Mammea.*

MAMMILLÀRIA (Latin, *mammila;* referring to the nipple-like tubercles on these plants). Often but not originally spelled *Mamillaria.* Stems simple, branching or in clusters from the root, commonly hemispherical or short-cylindrical, but often depressed or sometimes much elongated; the surface entirely broken up into tubercles (mamillæ): fls. usually short-funnelform, with naked or nearly naked tube and ovary, borne in the more or less woolly axils between the tubercles, or at the inner extremity of a narrow groove on their upper surface: fr. globose to linear-clavate, nearly always smooth and berry-like. The first subgenus is rather indefinitely separated from the tuberculate Echinocacti by the smooth fruit, and by the character of the groove, which in Mammillaria is hardly more than an impressed line, while in Echinocactus it is shorter and so broad as to be obviously a continuation of the spiniferous areola.

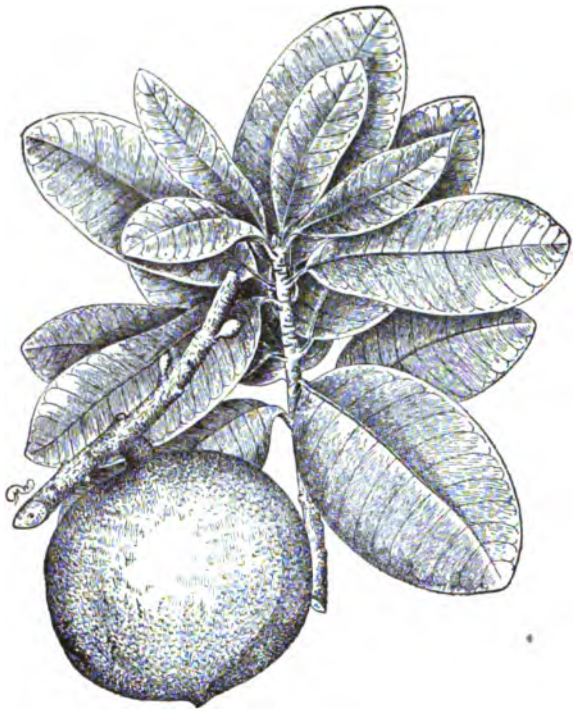
The cultivation of Mammillaria differs in no respect from Echinocactus, which see.

REVIEW OF SUBGENERA.

Subgenus I. CORYPHANTHA (flowering in vertex). Tubercles, at least the flowering ones, narrowly grooved on the upper side, from apex nearly to base, except in *M. macromeris.* Fls. showy. large for the genus. Fruit green or greenish, except in *M. tuberculosa* and *M. Missouriensis.* Seeds brown, lightly reticulated and thin-shelled, with ventral or subventral hilum, except in *dasyacantha* and *Missouriensis.* Species 1–24

Subgenus II. DOLICOTHELE. Tubercles cylindric-conical, long, loose and of soft texture. Fls. large, yellow, from the axils of the upper tubercles..................................Species 25

Subgenus III. COCHEMIEA. Stems elongated, forming large clumps: fls. in a crown near the apex, 1⅛–2 in. long, narrowly tubular-funnelform, somewhat curved and bilabiate, with widely spreading sepaloid scales, the whole flower uniformly waxy red; stamens and style exceeding the petals: fr. red: one or more centrals hooked, except sometimes in *M. Halei.* All from Lower California and adjacent islands. .... Species 26–29



1354. Mammea Americana—Mammee Apple, or St. Domingo Apricot (× ½). (See page 971.)

Subgenus IV. Eumamillaria. Fls. usually small, produced from the axils of grooveless tubercles, and nearly always remote from the vertex: fr. usually clavate and red, nearly always destitute of scales..........................Species 30–77

SUBGENUS I. CORYPHANTHA.

A. *Blossoms yellow: spines mostly yellow or yellowish, one or more honey-glands usually found in the groove.*

B. *Fls. remote from the vertex.*

C. *Glands one or two conspicuous red or yellow, in the axils: stems long, in age making large clumps: spines rather slender: radials ⅓–½ in. long, centrals ½–¾ in. long...* 1. **raphidacantha**

2. **macrothele**

3. **erecta**

CC. *Glands none in the axil...* 4. **recurvata**

BB. *Fls. central or nearly so: plants mostly globose or depressed, 1½–3 in. in diameter: radial spines laterally compressed near the base......................* 5. **Scheerii**

6. **robustispina**

C. *Stems nearly always simple: radial spines rather rigid and pectinately spreading: centrals 1–4, the upper turned up among the radials, the lower deflexed or horizontal. Species closely related and perhaps confluent ....* 7. **cornifera**

8. **daimonoceras**

9. **echinus**

10. **scolymoides**

CC. *Centrals none ....*11. **radians**

12. **pectinata**

13. **impexicoma**

CCC. *Stems cespitose from the grooves of the tubercles, often densely so: groove without glands but often spinose for most of its length: radial spines fewer and weaker: central solitary or wanting ....*14. **sulcata**

15. **Nickelsae**

16. **Missouriensis**

AA. *Blossoms purple or purplish: spines usually gray or glossy, the centrals and tips black or brown: ovary and fruit often scale-bearing.*

B. *Radial spines 10 or more, often very numerous, covering the whole plant: centrals at maturity rarely less than 4.*

C. *Glands small in a chain in some of the grooves: spines long but weak, not obscuring the body ......*17. **macromeris**

CC. *Glands none in axil or groove so far as known..*18. **conoidea**

19. **vivipara**

20. **radiosa**

21. **dasyacantha**

22. **tuberculosa**

BB. *Radial spines less than 10: central solitary or wanting: tubercles large and broad..*23. **cornuta**

24. **elephantidens**

SUBGENUS II. DOLICOTHELE.

25. **longimamma**

SUBGENUS III. COCHEMIEA.

26. **Roseana**

27. **setispina**

28. **Pondii**

29. **Halei**

SUBGENUS IV.

A. *Juice watery: tubercles rarely angular.*

B. *Spines (hooked) none: fls. yellowish or whitish, with rosy streaked petals.*

C. *Stems proportionately slender: tubercles short-ovate: radial spines rigid, spreading, recurved so that the points hardly project...........*30. **elongata**

31 **Leona**

CC. *Stems low, usually broader than high. No bristles in the axils, except in M. candida and M. plumosa.*

D. *Radial spines few, not hiding the body.................*32. **decipiens**

33. **fragilis**

DD. *Radial spines numerous, snowy white, covering and hiding the whole plant..........*34. **lasiacantha**

35. **plumosa**

36. **senilis**

37. **barbata**

38. **vetula**

39. **candida**

BB. *Spines one or more hooked and central, except in M. pusilla and M. dioica insularis.*
C. *Bristles one or more found in the axils between the tubercles* .... 40. **pusilla**
41. **Bocasana**
42. **Wildii**
43. **tetrancista**
44. **dioica**
45. **armillata**
CC. *Bristles none in the axils, except perhaps in M. Carretii* .... 46. **Wrightii**
47. **Goodrichii**
48. **Grahami**
49. **venusta**
50. **Mainæ**
51. **Carretii**
AA. *Juice milky none in the tubercles, but found or to be suspected in the body. No hooked spines. Radial spines less than 15; centrals usually 1.*
B. *Fls. yellow* .... 52. **eriacantha**
BB. *Fls. blood-red* .... 53. **sphacelata**
BBB. *Fls. carmine* .... 54. **spinosissima**
55. **rhodantha**
56. **dolichocentra**
57. **discolor**
58. **Lesaunieri**
59. **Haageana**
60. **elegans**
AAA. *Juice milky exuding from wounds in any part of the plant: stems not elongated: tubercles usually angular: no hooked spines, except in M. uncinata. Section Lactescentes.*
B. *Fls. red or purple or carmine, —said to be yellow in Parkinsonii.*
C. *Spines terete: radials white, setaceous, numerous, interwoven and covering the plant: stems at length cylindrical or clavate: axils woolly* .... 61. **bicolor**
62. **Parkinsonii**
63. **formosa**
CC. *Spines few, stouter, often angular, some of the centrals very long and more or less flexuous: tubercles rather large, angled: axils woolly* .... 64. **angularis**
65. **centricirrha**
66. **mutabilis**
67. **Heeseana**
BB. *Fls. whitish, yellowish or flesh-color.*
C. *Radial spines 9–22, seldom less than 12: tubercles slender, scarcely angled* . 68. **simplex**
69. **Brandegei**
70. **Heyderi**
CC. *Radial spines rarely as many as 9: body mostly depressed* .... 71. **meiacantha**
72. **carnea**
73. **uncinata**
74. **Trohartii**
75. **sempervivi**
76. **Caput-Medusæ**
77. **micromeris**

INDEX.

acanthophlegma, 60.
Alversoni, 20.
ancistracantha, 1.
angularis, 64.
applanata, 70.
aristina, 65.
Arizonica, 20.
armillata, 45.
aulacothele, 2.
aureiceps, 55.
autumnalis, 66.
barbata, 37.
bicolor, 61.
Bocasana, 41.
borealis, 20.
Brandegei, 69.
Brownii, 6.
calcarata, 14.
candida, 39.
Caput-Medusæ, 76.
carnea, 72.
Carretii, 51.
centricirrha, 65.
chlorantha, 20.
cirrhifera, 66.
conoidea, 18.
cornifera, 7.
cornuta, 23.
crassispina, 55.
daimonoceras, 8.
dasyacantha, 21.
decipiens, 32.
deflexispina, 65.
densa, 30.
denudata, 34.
deserti, 20.
dioica, 44.
discolor, 57.
dolichocentra, 56.
echinaria, 30.
echinata, 30.
Echinus, 9.
elegans, 60.
elephantidens, 24.
elongata, 30.
erecta, 3.
eriacantha, 52.
fissurata: See Anhalonium.
formosa, 63.
Försteri, 65.
fragilis, 33.
fulvispina, 55.
fuscata, 55.
Gabbii, 69.
Galeottii, 50, 56.
globosa, 25.
Goodrichii, 44, 47.
Grahami, 48.
Greggii, 77.
Guilleminiana, 32.
Haageana, 59.
Halei, 29.
Heeseana, 67.
hemisphærica, 70.
Heyderi, 70.
Hirschtiana, 20.
impexicoma, 13.
insularis, 44.
Klugei, 60.
Krameri, 65.
lasiacantha, 34.
Lehmanni, 2.
Leona, 31.
Lesaunieri, 58.
longimamma, 25.
macromeris, 17.
macrothele, 2.
Mainæ, 50.
meiacantha, 71.
micromeris, 77.
minima, 30.
Missouriensis, 16.
multiceps, 40.
mutabilis, 66.
Neo-Mexicana, 20.
Nickelsæ, 15.
nivea, 61.
Nogalensis, 4.
Nuttallii, 16.
Odieriana, 55.
Palmeri, 44.
Parkinsonii, 62.
pectinata, 12.
Petersonii, 67.
Pfeifferi, 55.
phellosperma, 43.
plumosa, 35.
Pondii, 28.
Potosina, 60.
prismatica: See Anhalonium.
pusilla, 40.
pyramidalis, 55.
radians, 11.
radiosa, 20.
Radliana, 26.
raphidacantha, 1.
recurvata, 4.
recurvispina, 4.
rhodantha, 55.
robustior, 16.
robustispina, 6.
Roseana, 26.
Rungei, 34.
sanguinea, 54.
Scheerii, 5.
Schmidtii, 65.
scolymoides, 10.
sempervivi, 75.
senilis, 36.
setispina, 27.
similis, 16.
simplex, 68.
sphacelata, 53.
sphærica, 25.
sphærotricha, 39.
spinosissima, 54.
stella-aurata, 30.
stellaris, 40.
stellatus, 40.
strobiliformis, 18, 22.
subangularis, 64.
sulcata, 14.
tenuis, 30.
tetracantha, 56, 65.
tetrancistra, 43.
Texana, 40.
Trohartii, 74.
tuberculosa, 22.
uberiformis, 25.
uncinata, 73.
venusta, 49.
vetula, 38.
vivipara, 19.
Wildiana, 42.
Wildii, 42.
Wissmanni, 16.
Wrightii, 46.

1. **raphidacántha**, Lem. Stems becoming 1 ft. or more long, 2–3 in. in diam., often clavate: tubercles erect-spreading, somewhat flattened, often with 1 or 2 glands in the groove: spines yellow in the young state, soon gray; radials 6–10; central 1, longer and stouter, straight or hooked in the same plant: fls. about 1 in. broad. San Luis Potosi, Mex.—The more constantly hooked form is *M. ancistracantha*, Lem.

2. **macrothèle**, Mart. (*M. aulacothèle*, Lem. *M. Léhmanni*, Otto). Stems stout, attaining nearly 2 ft. in height by 4 in. in diam.: tubercles long, conical, at first upright, in age becoming even deflexed: spines all yellow; radials 6–8, spreading; centrals 1–2, longer and stouter: fls. 1½–2 in. broad. Central Mex.

3. **eréeta**, Lem. Branching from base and from decumbent stems, attaining 12 in. or more in height by 3 in. in diam., bright green: tubercles conical, short, upright: spines all yellow; radials 8–13; centrals 4 or less: fls. 2–2½ in. in diam. Cent. Mex.—In the groove close to the spines is often found, especially in the flowering area, a conspicuous honey gland.

4. **recurvàta**, Engelm. (*M. recurvispina*, Engelm. *M. Nogalénsis*, Runge). Stems depressed-globose and often deeply concave, 6–8 in. in diam., forming large masses 1–3 ft. in diam.: tubercles short, with usually a large gland in the groove near the apex: spines yellow or whitish, stiff, recurved-pectinate, interwoven and covering the whole plant; radials 18–20; central 1, rarely 2, recurved: fls. about 1 in. long, brownish outside. Near Nogales, Arizona, and southward in Sonora.

5. **Scheèrii**, Mühlpf. Stems ovate-globose, 3–6 in. in diam., usually simple: tubercles large and distant, deeply grooved, with 1–5 glands in the groove: spines stout, rigid, sometimes reddish; radials 6–16; centrals 1–5, stouter and longer, 1 very stout and porrect: fls. 2 in. long: seeds large for the genus. S. W. Texas and southward in Mexico.

6. **robustispina**, Engelm. (*M. Brównii*, Toumey). Much like the preceding, but tubercles teretish, no glands in the groove or sometimes a single one at apex: spines very stout; radials 10–15; central 1, longer, straight, curved or even hooked, rarely an additional straight upper one: fls. 2 in. long, with very slender tube: seeds large. Babuquibari mountains south of Tucson, Ariz.

7 **cornifera,** DC. Tubercles ovate, thick, rather crowded: radial spines 15–17, ashy white, 6 lines long; central 1, longer and stouter, erect, somewhat curved. Mexico.

8. **daimonocèras,** Lem. Vertex impressed, very woolly: tubercles erect-conical: spines grayish; radials 20 or more, the upper accessory ones fascicled; centrals usually 3, stronger, the 2 upper divaricate and somewhat recurved, the lower horizontal or recurved. Mexico.

9. **Echinus,** Engelm. Differs from the above in the less depressed shape and rather more numerous spines. Southern Tex. to Mex.

10. **scolymoides,** Scheidw. At length somewhat cespitose: tubercles conical, bent inwards and imbricated: radial spines 14–20, whitish or horn-colored; centrals 1–4, longer and darker, the upper mingled with the upper radials, the lower stouter and bent downwards: fls. 2 in. in diam. Mex., south of the Rio Grande.

11. **ràdians,** DC. Stems simple: axils naked: tubercles oval, large: spines white, rigid, subtomentose. Mex.

12. **pectinàta,** Engelm. Stem simple: tubercles quadrangular at base, conical above; areolæ round-oblong: spines 16–24, yellowish, laterally compressed at base, stiff, pectinate, somewhat recurved: fls. 2½ in. in diam.; petals broadest above, obtusish. Pecos river and Leon Springs, Tex.

13. **impexicòma,** Lem. Vertex deeply impressed, densely woolly: tubercles somewhat angulate; areolæ round: spines 18–20, gray, rigid, covering the whole plant; very rarely a single porrect central. Mex.

14. **sulcàta,** Engelm. (*M. calcaràta*, Engelm.). Densely cespitose from the upper part of the groove: tubercles 7–9 lines long, ovate-oblong, with dilated base, somewhat imbricate, spreading in age: spines gray, rigid, subulate; radials 12–15, the upper 3–5, fascicled; central 1, recurved, wanting in younger plants: fls. 2½ in. in expansion, the tube red within; sepals not fringed. Tex., from the Brazos to the Nueces river.

15. **Nickelsæ,** Brandg. (*M. Nickelsii*, Hort.). Very near the preceding, but radial spines more numerous, 14–18, the fascicled upper ones much longer than the lower, and no central. Mex., south of Laredo, Tex.

16. **Missouriénsis,** Sweet (*M. Núttallii*, Engelm.). Nearly simple, 1–2 in. in diam.: tubercles cylindric-conical, loose and spreading, slightly grooved: spines white, weak, puberulent, not hiding the body; radials 12–17, spreading; central one longer and stouter, often wanting; fls. about 1 in. long, yellow to fawn-color, with reddish streak; sepals fimbriate; petals acute or acuminate: berry red, the shape and size of a small pea; seeds black and pitted. Mont. to Kans. and E. Colo.

Var. **símilis,** Engelm. Cespitose, in clumps often a foot broad: spines fewer: fl. and fr. larger. Kansas river to Texas.

Var. **robústior,** Engelm. (*M. Wissmannii*, Hildm.). Almost simple: tubercles longer and looser: spines smooth, rather short and stout; radials 10–12; central 1: fls. even larger than in *M. similis*. Tex.

17. **macromèris,** Engelm. Fig. 1355. Low, usually soon proliferous, dark green: tubercles large and long, loose and spreading, but often incurved; groove rather short; radials 10–17, weak, slender and spreading; centrals at maturity usually 4, somewhat stouter and much longer, sometimes more than 2 in. long: fls. purple, often 3 in. in expansion; petals erose, mucronate: fr. with several scales on the ovary. Along the Rio Grande from New Mexico to Texas. See, also, Fig. 746*a*.

18. **conoídea,** DC. (*M. strobilifórmis*, Engelm.). Ovate-conical, with densely woolly vertex: tubercles short, usually densely appressed-imbricate in 8–10 spiral, rib-like rows: radial spines 10–16, straight and stout; centrals 3–5, stouter, blackish, the upper ones erect-spreading, the lower stouter, horizontal or deflexed: fls. about 1 in. in expansion, deep purple, paler outside: fr. short, buried and hidden in the axillary wool. N. E. Mex.

19. **vivípara,** Haw. Fig. 1356. Low and depressed-globose, usually cespitose, forming large masses: tubercles terete and loose: radial spines 12–20, slender but stiff; centrals usually 4, but sometimes as many as 8. brownish, the upper erect-spreading, the lower stouter and deflexed: fls. bright purple, 1–1½ in. in expansion; stigmas mucronate. From southern Br. Am., through the upper Missouri region to E. Colo.

20. **radiòsa,** Engelm. Ovate or cylindrical, sometimes proliferous: tubercles terete: radial spines 20–30, white, with dusky apex, very unequal; centruls 4 or 5, stouter and longer, tawny, upper ones longer, lowest shorter and horizontal: fls. 1½–2 in. in expansion; stigmas obtuse. Southern Tex. and northern Mex.

Var. **Neo-Mexicàna,** Engelm. (*M. Hirschtiàna*, Haage. Jun.). Lower, more or less proliferous from the lower grooves: radial spines 20–40, white; centrals 3–12, white below, blackish above.

Var. **boreàlis,** Engelm. Ovate or subglobose: radial spines 12–20; centrals 3–6, purple-spotted. Very near *M. vivipara*.

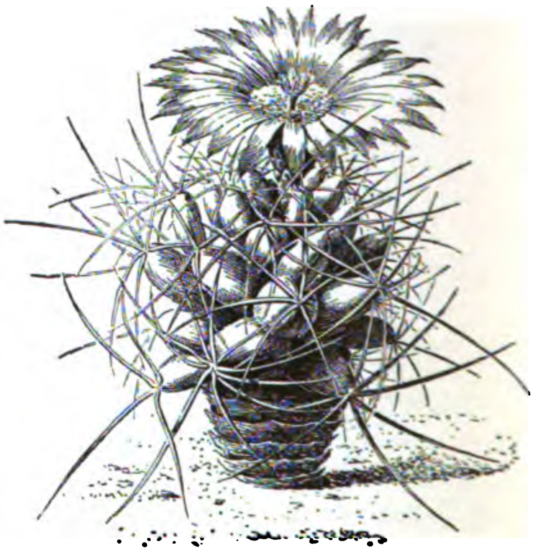
Var. **Arizónica,** Engelm. Globose or ovate, large: tubercles long-cylindrical: radial spines 15–20, whitish: centrals 3–6, deep brown above: fls. large, rose-colored. N. Arizona.

Var. **desérti,** Engelm. Low, simple, with slender nearly cylindric tubercles: radial spines 15–20; centrals 8–10, reddish tipped: fls. straw-colored, with purplish tips. Ivanpah, Calif.

Var. **chlorántha,** Engelm. Cylindrical, sometimes as much as 9 in. high: radial spines 20–25, almost in 2 series, gray; centrals 6–9, stouter, ½–1 in. long, reddish only at tip: fls. greenish yellow. S. Utah.

Var. **Álversoni,** Coulter. "FOXTAIL CACTUS." Robust and branching, sometimes 10 in. long, glaucous: tubercles short and broad, somewhat angled, forming more or less distinct ribs: radial spines numerous; centrals 8–14, stout, spreading, blackish half-way down: fls. pink. S. E. Calif.

21. **dasyacántha,** Engelm. Simple, subglobose: tubercles terete, loose: radial spines 25–35, hair-like, white, with brownish apex; centrals 7–13, bristle-like, pale below, brown above, longer, the most interior one horizontal, sometimes wanting: seeds black. with nearly basal hilum. Tex.



1355. Mammillaria macromeris (× ½). No. 17.

22. **tuberculòsa,** Engelm. (*M. strobilifórmis*, Scheer). Ovate or cylindric, rather slender, somewhat dry of texture, the spines falling from the older tubercles, leaving them as dry, corky protuberances: tubercles short-ovate from a broad base; axils densely woolly: radial spines 20–30, slender, rigid, white; centrals 5–9, stouter, pur-

plish above, the upper longer, erect, the lowest horizontal or deflexed: fls. 1 in. in diam., pale purple: fr. ¾ in. long, red, with a conical cap formed of the withered remains of the flower: seeds brown. Tex.

23. **cornùta,** Hildm. Depressed-globose or hemispherical, small, grayish green: tubercles large, flattened and imbricated; areolæ round: radial spines 5–7, stout, short, compressed, radiant, grayish, the upper longer; central 1, stouter, as long as the radials: fls. rose-red. "In age the spines fall off and the plant, covered with imbricated, scale-like tubercles, reminds one of a pineapple." Mexico.

1356. **Mammillaria vivipara** (× ½). No. 19.

24. **elephántidens,** Lem. Rather large, glaucous green: tubercles very large and thick, becoming horizontal or deflexed and somewhat bilobed: spines 6–8, all radial, stout, yellowish or gray, appressed to the plant and somewhat recurved: fls. rose-color, 3 in. in expansion. Mexico.

25. **longimámma,** DC. Cespitose, bright green, forming large, low clumps: tubercles sometimes more than 2 inches long: spines straight, pubescent; radials 7–10; central 1: fls. 2 in. or more in expansion. Mexico.

Var. **uberifórmis,** Schum. Tubercles darker green: radial spines seldom more than 4; centrals none.

Var. **globòsa,** Schum. Tubercles dark green, very long: radial spines as many as 12; centrals 2–3.

Var. **sphǽrica,** Engelm. Tubercles about 1 in. long. radial spines 12–14; central 1. Tex.

26. **Roseàna,** Brandg. (*M. Radliàna*, Quehl.). Upright branches 1–1½ ft. long, 1½–3 in. in diam.: tubercles rather remote, flattened and appressed, later spreading: radial spines 8; central 1, brownish, strongly hooked, 1–2 in. long, twice as long as the radials: fr. bright red, flat on the broad top and much shorter than the tubercles.

27. **setispìna,** Engelm. Upright branches 8–12 in. long, 2–4 in. in diam., forming dense clumps: tubercles rather crowded, ovate, short: spines white with black tips; radials 10–12; centrals 1–4, stouter, the lower one strongly hooked, often twisted, 1½–2 in. long, 2 or 3 times as long as the radials: fr. red, much exceeding the tubercles.

28. **Póndii,** Greene. Upright branches 10–15 in. long, 1½–2 in. in diam., making much smaller clumps than the two preceding: tubercles short, ovate, not crowded; axils setose: spines in three series, outer 15–25, short, white; inner 5–8, brown, longer; central row 3, brown, usually 2 of them strongly hooked, 1 in. or more in length, much exceeding the other spines: fr. oval or obovate, dull purplish red, ¾ in. long.

29. **Hàlei,** Brandg. Upright branches 1½–2 ft. high, 2–3 in. in diam.: tubercles rather crowded, short-conical from a broad base: spines sub-3-serrate, outer 15–25; centrals 6–9, darker, the lower one much stouter, an inch or more long, usually straight but sometimes hooked, twice as long as the other spines: fr. obovate, red.

30. **elongàta,** DC. (*M. dénsa*, Link & Otto). Erect, 6–7 in. long, 1–1½ in. thick: radial spines 16–18, yellow; centrals none: fls. white or yellowish. Central Mex.

Var. **echinàta,** Schum. (*M. echinàta* and *M. echinaria*, DC.). Radials as many as 20, yellow; centrals 2–3, brown.—A stout form.

Var. **ténuis,** Schum. (*M. ténuis*, DC. *M. minima*, Salm.) Radial spines about 20, pale yellow; centrals none—The most slender form, only ½ in. thick.

Var. **stélla-auràta,** Schum. Stems somewhat thicker: spines golden yellow; 1 central usually present.

31. **Leòna,** Pos. Stems stouter, glaucous, upper axils woolly: radial spines about 30, radiant, slender, white; centrals 6–12, much stouter; the upper ones longest, ivory white at base, dove-color or bluish above. Nuevo Leon, Mex.

32. **decipiens,** Scheidw. (*M. Guilleminiàna*, Lem.). Irregularly cespitose, somewhat clavate, often rosy: tubercles cylindrical; axils sparingly bristly: radial spines 7–12, whitish; centrals 1–2, brown, longer; all slender. Mex.

33. **frágilis,** Salm. Stems low, usually as broad or broader than high, extremely proliferous, the offsets so lightly attached that they soon fall by their own weight: radial spines 12–14, white; centrals none or 1, rarely 2, white, with dusky tip. Mex.

34. **lasiacántha,** Engelm. Low, usually globose or depressed-globose: tubercles slender, axils naked: radial spines as many as 40–80, feathery; centrals none. Tex.

Var. **denudàta,** Engelm. (*M. Rúngei*, Hort.). Larger, both plant and tubercles: spines naked. Cact.

35. **plumòsa,** Web. Densely cespitose, at length forming masses 6–10 in. in diameter; axils long-hairy: radical spines about 40, feathered to the tip; centrals none.—This and the preceding are like feathery balls. *M. plumosa* is sold usually under the name of *M. lasiacantha*, to which it appears to be rather closely related. North Mex.

36. **senílis,** Salm. "Proliferous at base: axils not setose: tubercles crowded: spines all white; exterior very numerous, erect-spreading, hair-like, flexuous; centrals 4–6, a little stronger, the upper and lower hooked." Chihuahua, Mex.

37. **barbàta,** Engelm. Globose-depressed: axils not setose: exterior spines very numerous, pilose; interior stronger, yellowish, 10–15; central solitary, stout-hooked, yellowish, not much longer than the others: fls. small, not remote from the center; sepals fimbriate: berry "green." Near Chihuahua, Mex.

38. **vétula,** Mart. Subglobose or becoming subcylindrical: axils not setose: radial spines bristle-like, at first 25–30, obliquely spreading, later twice as many and horizontal; centrals 1–3, yellowish brown, scarcely stouter or longer. Mex.

39. **cándida,** Scheidw. (*M. sphærótricha*, Lem.). At length cespitose, globose, becoming longer: vertex depressed: axils setose: radial spines bristle-like, more than 50, horizontal and interwoven; inner spines 8, 10, 12. or more, a little stouter and upright: fls. flesh-color or pinkish.

40. **pusílla,** DC. (*Cáctus stellàtus*, Willd. *M. stellàris*, Haw.). Low, globular, proliferous, making large masses: tubercles cylindrical, small and loosely spreading; axils with long, hair-like, tortuous bristles: radial spines 12–20, very soft and flexuous; centrals 4–6, yellowish, a little rigid, pubescent: fls. yellowish white. W. Indies.

Var. **múlticeps,** Salm. Larger: tubercles upright, crowded: radial spines numerous; centrals 6–8, slender, pubescent, reddish yellow. Mex.

Var. **Texàna**, Engelm. Larger than the last: spines in 3 series; outer capillary, crisped, 30–50; interior 10–12, a little more rigid, pubescent, white; centrals 5–8, longer, stouter, pubescent, yellow at tip. Tex. and adjacent Mex. Cact.

41. **Bocasàna**, Pos. Depressed-globose, or a little lengthened, at length densely cespitose: axillary bristles as long or longer than the tubercles: radial spines 25–30, white, stiff at the base, ending in a flexuous thread; centrals 2–3, slender, porrect, short, all yellow with brown tips, the hooked one brown nearly to the base, pubescent. Mex.

42. **Wildii**, Dietr. (*M. Wildiàna*, Otto). Cespitose, forming hemispherical clumps: radial spines 8–10, very slender, white, spreading; centrals usually 3–4, a little stouter and longer, honey-yellow, brown at base, pubescent, 1-hooked. Mex.

43. **tetrancistra**, Engelm. (*M. phellospérma*, Engelm.). Ovate or ovate-cylindrical, rather large, simple or sparingly branched from the base: young axils sparingly setose: radial spines 30–60, in two series; exterior bristle-like, white; interior stouter and longer, dusky-tipped or purplish; centrals 1–4, longer, brown or blackish, sometimes all hooked, the upper ones sometimes straight: seed partly immersed in a brown corky cup. S. Calif. to Utah. Cact.

44. **diòica**, Brandg. (*M. Goòdrichii*, of California). Simple or cespitose from the base, ovate to cylindrical, 3–8 in. high: tubercles somewhat angular and leathery: radial spines 11–22, white, with brown or purple tips; centrals 1–4, longer and darker, the upper turned up among the radials, the lower porrect and strongly hooked: fls. often unisexual, yellowish white with rosy streak. Calif. and Lower Calif.

Var. **insulàris**, Brandg. (*M. Pálmeri*, Coult., not of Jac.). Stems densely cespitose, shorter: axils densely woolly: spines much whiter, usually all straight. San Benito Island.

45. **armillàta**, Brandg. Taller, often 1 ft. in height, branching at base and along the stem: tubercles crowded: radial spines 9–15; centrals 1–4, nearly twice as long: fls. small, yellowish, scarcely spreading. Lower Calif.—The plant is marked by darker circular bands.

46. **Wrightii**, Engelm. Globose or depressed, top-shaped below: radial spines 8–12, white, pubescent; centrals 1–3, reddish black, scarcely longer than radials, all hooked; fls. about 1 in. long, purple. New Mexico.

47. **Goòdrichii**, Scheer. Erect, cylindrical, branching at base; axils naked: radial spines about 12, white; centrals 4, white below, brown above, the 3 upper erect-spreading, the lower longer. Cedros Island and Lower California.

48. **Gràhami**, Engelm. Globose or ovate, somewhat cespitose: radial spines 15–30, white, often dusky at tip, the upper ones shorter; centrals usually 4, usually blackish from a paler base, the 3 upper turned up among the radials, and, when pale, hardly to be distinguished from them; lower porrect: fls. rose-colored, 1 in. in expansion: fr. nearly 1 in. long. From Texas to S. California and adjacent Mexico.

49. **venústa**, Brandg. Globose or hemispherical, small, often cespitose: tubercles very thick and blunt, concave at the end, usually extremely glaucous: radial spines 9–15, stout, from pure white to white below and brownish above; central commonly 1, sometimes 2 or 3, the lower little longer and darker than the radials: fls. rose-color, 1½ in. in expansion: fr. scarcely juicy, nearly 1 in. long, circumscissile near the base. So. Lower California.

50. **Mainæ**, Brandg. Hemispherical to ovate, usually simple: tubercles somewhat incurved, glaucous, the lower part and the axils often bright rose-red: radial spines 10–15, yellowish becoming gray, the upper shorter; centrals 1–3, the upper shorter and smaller, turned upward, one of them sometimes hooked, lower central stout, strongly hooked, somewhat twisted, yellowish below, black at tip: fls. flesh-color: fr. shorter than the tubercles. Vicinity of Nogales, Arizona.—Sent out as *M. Galeottii*.

51. **Cárretti**, Schum. Simple, depressed-globose, rather small: radial spines spreading-recurved and interwoven, rather long, yellowish; central 1, slender, chestnut-brown, paler below: fl. whitish, with rosy streak in petals; sepals long-acuminate. Mex.—The only specimen seen has bristles in the axils.

52. **eriacántha**, Link and Otto. Cylindrical, elongated, ½ ft. and more in height ("reaching 20 inches") by 2–2½ in. in diam.: tubercles crowded, acutely conical: spines all pubescent; radials 20–24, pale yellow, bristle-like: centrals 2, stronger, nearly twice as long as the radials, golden yellow, one directed, the other downwards: fls. yellow, small: fr. yellow. Mex.

53. **sphacelàta.** Stems cespitose, cylindrical, 6 in. or more long, 1 in. in diam.: tubercles short, conical from a broader, rhombic base: spines ivory white with blackish tips; radials 12–18, horizontal-spreading; centrals 3–4, upright: fls. small, the petals acute. Mex.—The proper position of this and of the preceding species is still quite uncertain.

54. **spinosíssima**, Lem. Stems cylindrical, reaching 1 ft. in height and 2½ in. in diam.: tubercles short, ovate-conic, somewhat tetragonal: radial spines 20–25, setiform, white, spreading; centrals 12–15, brownish red, stronger and twice the length of the radials. Mex.

Var. **sanguínea**, Hge. Stem somewhat clavate, rather shorter and stouter: radial spines 18–20, spreading, white; centrals 8, only a little longer, but thicker and bulbous at base, white with brownish base and dark brown tip, the young ones dark blood-red. Mex.

55. **rhodántha**, Link and Otto (*M. Odieriàna*, Lem. *M. fulvispina*, Haw.). Stem long-cylindric or clavate, reaching more than 1 ft. in height, usually 2-parted: axils bristly: radial spines 16–20, white, bristle-like, horizontal-spreading; centrals 4–6, rigid, white or yellowish, the upper black at tip. Mex.

Var. **pyramidàlis**, Schum. Central spines dark brown, the young ones ruby red.

Var. **Pfeifferi**, Schum. (*M. aurèiceps*, Lem.). Radial spines 25 or more, yellow; centrals 6–7, recurved spreading, golden brown.

Var. **crassispina**, Schum. Radial spines 24–27, whitish: centrals 6–7, larger and stouter, more curved, darker.

Var. **fuscàta**, Schum. Axils naked; tubercles 4-angular at base: radial spines 25–28, radiant, bright yellowish brown: centrals 6, stout, strongly curved, the upper very long.

56. **dolichocéntra**, Lem. (*M. tetracántha*, Hook.). Subglobose (but said to reach a yard in height): tubercles somewhat 4-angled; areolæ elliptic or rhombic: radial spines none; centrals 4, slender, rigid, the upper curved upward, 1–1½ in. long, the three lower half as long, all grayish brown. Mex.

Var. **Galeóttii**, Först. Radial bristles 8–14, very short, soon falling; centrals 4, seldom 1 or 2 more, spreading, yellowish, with points, the upper and lower longest. Mex.

57. **discolor**, Haw. Globose or ovate, glaucous: outer spines 16–20, white, radiant; interior 6, rigid, recurved, white below, black above, upper and lowermost very long. Mex.

58. **Lesaunièri**, Schum. Hemispherical or very short-cylindrical (habit of *M. Heyderi*): spines brownish, short; radials 11–13; central upright, stronger.

59. **Haageàna**, Pfr. Cespitose: heads small, at length cylindrical, slender: tubercles small, crowded; axils woolly: radial spines about 20, pure white, only about 1½ lines long; centrals 2, black, slender, elongated, upper 3, lower 4 lines long. Mex.

60. **élegans**, DC. (*M. acanthophlégma*, Lehm. *M. Potosina*, Hort. *M. Klùgii*, Ehrh.). Simple, then proliferous and densely cespitose, depressed-globose, later lengthened: tubercles crowded, very small: radial spines more than 20, bristle-like, about 3 lines long, pure white, interwoven and covering the whole plant; central spines 2 (1–3), with brown tips, the one directed upward, the other downward, about twice as long as radials, in the axils abundant long white wool. Mex.

61. **bicolor**, Lehm. Simple or proliferous: tubercles small, crowded, ovate-pyramidal: radial spines 16–20; centrals 2, less than 1 in. long, stouter, erect, black-tipped. Mex.

Var. **nívea**, Schum. Obovate proliferous tubercles conical: radial spines capillary; centrals 4, white, with dusky apex, upper one incurved, 1 in. long.

62. **Párkinsonii**, Ehrh. At length dichotomously divided: tubercles slenderly pyramidal; axils woolly and bristly: radial spines 20 or more, slender; centrals 2, 3, 4, rarely 5, brown-tipped, the upper ones 3–4 lines long, the lower 1⅓ in. turned downward. Mex.

63. **formòsa**, Scheidw. Nearly simple: tubercles 4-angled: radial spines 18–22, rather rigid; centrals 6, a little longer, stiffer, thickened at base, reddish or brownish tipped.

64. **angulàris**, Link & Otto (*M. subangulàris*, DC.). Densely cespitose: axils of the young tubercles setose as well as woolly: radial spines 3–7, the upper ones often very short, the lower one sometimes 3 in. long, occasionally a very long central present. Mex.

65. **centricírrha**, Lem. (*M. arietìna* and *deflexispìna*, Lem. *M. Fórsteri* and *Kràmeri*, Mühlpf. *M. Schmídtii*, Scke. *M. tetracántha*, Hort.). Copiously proliferous: tubercles pyramidal, 4-angular: spines irregular, mostly 4–6 radials and 1 central, sometimes only 1, sometimes 2 centrals with 1–2 very short radials or none; radials very stout, straight or curved, awl-shaped, reaching ¾ in.; central stouter, sometimes nearly 2 in. long; young spines yellow. Mex.

66. **mutábilis**, Scheidw. (*M. autumnàlis*, Dietr. *M. cirrhífera*, Mart.). At length sparingly cespetose, depressed-globose or short-cylindric: tubercles pyramidal, 4-angled: axils with stout bristles in the wool: radial spines 1–6, very small; centrals 1–4, angled, flexuous, much longer, particularly the upper one, which reaches 2 in. Mex.

67. **Heeseàna**, McDow. (*M. Pètersonii*, Hildm.). Simple, glaucous or ashy green: tubercles pyramidal, 4-angled: radial spines 10–14, the three upper pure white and very short, the remainder longer and brownish-tipped; centrals 4, the upper ones erect and forming an elevated covering for the top of the plant, the lower one the longest, 2 in. long and projecting. Mex.—Varies in color of spines.

68. **símplex**, Haw. Globose or short-cylindric: radial spines 12–17, the middle ones longest; centrals 4–5, somewhat longer, reddish to black: flower brownish green without, yellowish or whitish green within: fr. red, ⅓ in. long, clavate; seed "black." Cuba.

69. **Brándegei**, Coult. (*M. Gábbii*, Coult.). Depressed-globose to short-cylindric or clavate: tubercles slender: radial spines 9–16; centrals 1–4, sometimes shorter than the radials, and stout, sometimes longer and slender, white to brown: fls. reddish brown without, brownish green within: fr. clavate, white, tinged lilac. Central lower Calif.

70. **Heýderi**, Muhlpf. (*M. Texénsis*, Lab.). Tubercles slender: spines short: radials 16–18, short, slender, white; central 1, darker, shorter than the lower radials, brown: fls. yellowish, with pale rosy streak in the petals. Arizona to Texas.

Var. **applanàta**, Engelm. Body much depressed, summit flat or concave: radial spines 15–22. Texas.

Var. **hemisphǽrica**, Engelm. Top rounded, radial spines 9–12. N. E. Mex.

71. **meiacántha**, Engelm. Fig. 1357. Usually simple: tubercles rather large, sharply angled and 4-sided, pyramidal: radial spines 5–9, mostly 6, white or yellowish; central 1, rarely a second, shorter and darker than the radials: fls. whitish, with reddish streak. Tex.

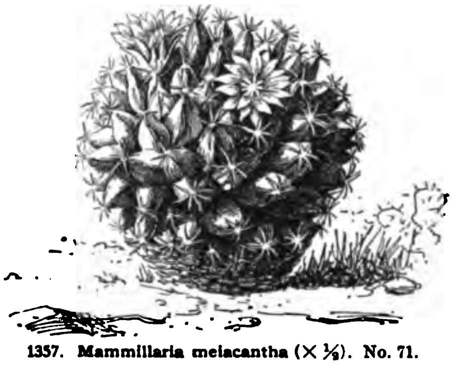
72. **cárnea**, Zucc. Body dark green: tubercles rather large, pyramidal, 4-angled: radial usually none, rarely 1–2; centrals commonly 4, in upright cross, stiff, grayish, with darker tip, in young growth dark brown or reddish: fls. reddish flesh-color. Mex.

73. **uncinàta**, Zucc. Depressed-globose to subclavate: tubercles pyramidal, not strongly angled: radial spines 4–6, short, gray, dark-tipped; centrals 1, rarely more, longer and stronger, strongly hooked, dark. Mex.

74. **Trohártii**, Schum. Globose or depressed, small: tubercles very small, conical, scarcely angled: radial spines 5, white with dark brown tips, the lower longest; central 1, dark brown, stiff. Mex.

75. **sempérvivi**, DC. Globose, blackish green, axils woolly: tubercles short, angled: radial spines 3–7, very short, only found on young tubercles; centrals only about 2 lines long, stout, conical, reddish, later gray: fls. dull white with reddish streak. Mex.

76. **Caput-Medùsæ**, Otto. Depressed-globose, dull, glaucous green, small: tubercles slender, angled at base: spines 3–6, very short, subulate, straight, reddish when young, later gray, pubescent: fls. whitish, red-streaked. Mexico. Monog. Cact. fig. 95.



1357. Mammillaria meiacantha (× ⅓). No. 71.

77. **micromèris**, Engelm. Cylindrical-clavate, 1–6 in. high, covered by white spines: tubercles only ⅓ line long: spines on the body very short, many serial, successively shorter toward the center, not pungent; in the flowering area the upper tuft of spines having a clavate deciduous tip: fls. pinkish white, borne at the summit in a dense tuft of wool and spines, directly behind the apex of the tubercle: fr. red, smooth. Texas.

Var. **Gréggii**, Engelm. Larger in all its parts. This plant is not a Mammillaria, and has been recently named *Echinocactus micromeris*, Web.

Mammillarias, in common with other Cacti, run into many forms. Some of these forms may be valuable to the horticulturist, and yet not sufficiently distinct to warrant the giving of definite botanical names. The following names, not accounted for in the above review, are offered in the catalogues of American dealers: *M. Brandi*.—*M. brunea*.—*M. cirrhifera longispina* (see No. 66).—*M. Donati*.—*M. filipendula*.—*M. fuscata leona* (see Nos. 55, 31).—*M. Lassomeri*=M. Lesaunieri (?).—*M. melonacantha* is an uncertain garden name.—*M. montana*.—*M. Nicholsoni*=M. Nickelsæ (?).—*M. Rebsamiana*.—*M. recurvens*.—*M. rigidispina*.

KATHARINE BRANDEGEE.

MANDARIN ORANGE. See *Citrus nobilis*.

MANDEVÌLLA (Henry John Mandeville, English minister at Buenos Ayres). *Apocynàceæ*. About 45 species of tall climbers from tropical America with large, funnel-shaped, 5-lobed fls. which are yellow, white or rarely tinged violet. *M. suaveolens* has fragrant white fls. and is cult. outdoors in S. Calif. Seeds are also procurable in the East. The plant closely resembles Dipladenia, which see for culture.

Generic characters: lvs. opposite: racemes simple, often 1-seeded, loose, dense or reduced to 2 or 3 fls.: calyx 5-parted, with several glands inside at the base or 5 scales; corolla tube cylindrical or ovoid; lobes 5, broad, twisted to the left; stamens fixed at the apex of the tube, included; disk of 5 lobes or scales: ovary of 2 distinct carpels: stigma thick.

suavèolens, Lindl. Sometimes called Chilean Jasmine because of its climbing habit and large white fragrant fls. Lvs. cordate, stalked, glabrous above, glaucous beneath; stipules pectinate: racemes with about 9 fls.

each 2 in. across. Argentine Rep. B.R. 26:7. B.M. 3797. Gn. 29, p. 537. G.C. III. 2:817. P.M. 16:289. R.H. 1845:167.—Characterized by a pale, fleshy pectinate ring between the base of the calyx and corolla. W. M.

MANDRÁGORA (name used by Hippocrates; referring to its growing near stables in the market places). *Solanàceæ*. A genus of 3 species, one of which is supposed to be the Mandrake mentioned in Genesis, chap. 30. In America the name Mandrake is applied to the May-apple, *Podophyllum peltatum*, but the Mandrake of history was a plant with a large spindle-shaped root which was supposed sometimes to become forked and resemble the human form. In this condition it was used as an aphrodisiac. The plant was also called Love-apple, and many superstitions about it still survive. The old herbals abound in fanciful pictures of the Mandrake, one of which is reproduced in Fig. 1358. *M. officinarum* is sold in America and may be cult. in the hardy border for its folk-lore interest. *M. autumnalis* is supposed by some to be the true Mandrake. Both are natives of the Mediterranean region. *M. caulescens* is found in the Himalayas.

1358. Mandrake.
From an old herbal (see *Mandragora*).

Mandragoras are nearly stemless, perennial herbs with thick roots and large, stalked, wavy-margined lvs., the later ones being usually narrower and entire, and rather large fls. varying from whitish through bluish violet and purplish shades. The fls. are bell-shaped, about 5-cut, netted-veined and borne in clusters among the tufted lvs. Calyx deeply 5-cut; sinus of the corolla induplicate between the lobes.

officinàrum, Linn. (*M. officinàlis*, Mill.). MANDRAKE. Lvs. ovate, the first obtuse, the rest acuminate: calyx teeth lanceolate, as long as the oblong berry. Woolson says it needs a shady place. R.H. 1897, p. 131. W. M.

MANDRAKE in America means the May Apple (Podophyllum) but the Mandrake of history is *Mandragora*.

MANÉTTIA (Xavier Manetti, of the botanic garden at Florence, born 1723). *Rubiàceæ*. This includes the common Manettia Vine, *M. bicolor*, which has scarlet, tubular fls. an inch or more long, with 5 spreading yellow tips. It is a twining plant, and is often trained to pillars and trellises both indoors and out, as it blooms more or less the year round. It can also be trained into a bushy form. By Index Kewensis *M. bicolor* is referred *M. luteo-rubra*, although the former is the older name. William Watson writes of *M. bicolor* (Gn. 56, p. 6): "It has been in cultivation about fifty years, but until recently it was practically lost, and its place and name taken by a much inferior species, the correct name of which is *M. luteo-rubra*. I believe we are indebted to Mr. Godseff for the recovery of the true plant, he having found it in cultivation in the United States a few years ago." Apparently the chief recorded difference between these two species is that the calyx-lobes of *M. bicolor* are lanceolate or narrower, while those of *M. luteo-rubra* are ovate.

The Manettia Vine is a rather old-fashioned plant, and generally easy of culture. It is fairly satisfactory as a cool conservatory vine, but is an easy prey to red spider and mealy bug. The fls. are short-lived, and not the best for cutting. Some gardeners would rather have Cupheas or *Jacobinia Penrhosiensis*. Manettias are prop. by cuttings of young growth inserted in sand with bottom heat. For summer use the vines should have a sheltered but sunny position.

Manettia is a genus of about 30 species of twining herbs and slender subshrubs from tropical and subtropical America. Glabrous or villous: lvs. usually long-acuminate: fls. small or rather large, axillary, solitary or in short corymbs or panicles, white, blue or red; calyx-lobes 4, rarely 5, short or long, narrow or broad: corolla tube short or long, terete or angled, straight or curved, glabrous or pilose within; stamens 4. "*Matsea glabra* or Manettia" is advertised in Amer., but no Matsea appears in botanical treatises.

A. *Fls. red, tipped yellow.*

B. *Calyx-lobes lanceolate, narrow.*

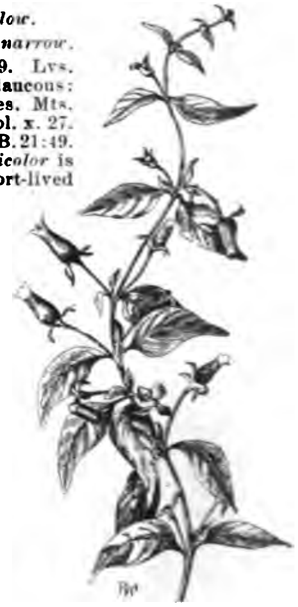
bicolor, Paxt. Fig. 1359. Lvs. lanceolate acute, slightly glaucous: calyx of 4 or 8 reflexed lobes. Mts. near Rio Janiero. P. M. Vol. x. 27. Gn. 56:1229. F.S. 2:69. R.B. 21:49. Gt. 47, p. 214.—*Manettia bicolor* is easy to grow, but it is short-lived and consequently must be renewed often. Well-trained specimens are very pretty.

BB. *Calyx-lobes ovate-acuminate, leafy.*

lùteo-rùbra, Benth. Pubescent: lvs. ovate or oblong, acute, narrowed at the base, tomentose beneath: pedicels solitary: calyx not toothed in the sinuses: corolla tomentose outside, equally tubular, straight. Brazil.—The above is a full translation of the original description.

AA. *Fls. red.*

cordifòlia, Mart. (*M. cordàta*, Hort.). Lvs. ovate, cordate at base, finely pubescent on both sides: peduncles axillary, 1-fld. Brazil. B.R. 22:1866. B.M. 3202.—Cult. outdoors in Fla. and Calif., and makes a fine subject for planting out in the North. W. M.



1359. Manettia bicolor ($\times \frac{1}{3}$).

MANFRÈDA. See *Agave*.

MANGEL-WURZEL. A race of beets with very large roots, grown for fodder. Often called *Beta vulgaris*, var. *macrorrhiza*.

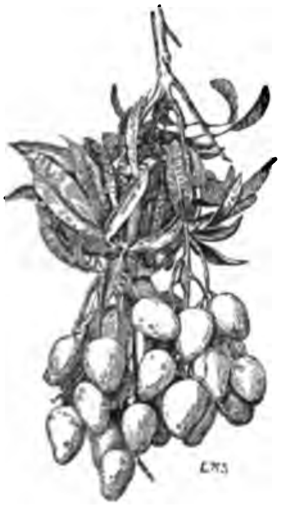
MANGÍFERA (Latin, *mango-bearing*: Mango being the Hindoo name of the fruit). *Anacardiàceæ*. A genus of 27 species of tropical Asian trees, of which *M. Indica*, the Mango, is cult. everywhere in the tropics. The fruit (Fig. 1360) is large (4–5 in. long) and kidney-shaped, the skin being smooth, rather soft, pale green, yellow or half-red, and resinous. Inside is a large seed nearly as long as the fruit. The shell of the seed is rough and fibrous; the kernel is shaped like a bean and is sometimes roasted and eaten like chestnuts. In a poor variety of Mango the pulp is so full of fiber that the fruit is sucked rather than eaten, and beginners say it tastes like a ball of cotton soaked in turpentine and molasses. This is particularly true of the common or turpentine variety, but the improved kinds are not unpleasantly fibrous. There are said to be 130 or more varieties cult. in India, where the Mango is most esteemed. All parts of the Mango tree have a sweet, resinous fragrance which suggests turpentine.

In the tropics the Mango is a staple article of food during the hot months. The ripe fruits are eaten raw, either plain or sliced with wine, sugar and nutmeg. The unripe fruits are made into jellies, preserves, tarts and pickles. Starch and glucose are also made from Mangoes. A wine is made by adding vinegar to the juice of Mangoes. Various domestic animals are also fond of the fruit. As to quality, the Mango is ranked by some next to the finest pineapples and the mangosteen.

The Mango is extensively cultivated in the West Indies, and slightly in S. Fla. and S. Calif. A sketch of its history in Florida is found in Bulletin 1, Div. of Pomology, U. S. Dept. of Agric., from which the following facts are taken: No fruit stood higher in the popular esteem in parts of south Florida than the Mango at the time when the disastrous freeze of January, 1886, killed to the ground every or almost every tree north of Fort Myers. In 1884, 125,000 fruits were shipped from Jamaica to the United States, and brought $900. In their eighth year from seed two Florida trees bore 19.000 fruits. Some of these fruits weighed a pound. In all cases where the trees were well cared for they produced from 4,000 to 9,000 Mangoes each when once well in bearing. Mangoes were shipped to Chicago and brought 60 cents a dozen. The fruit ripens June–Sept. The only varieties advertised in America in 1899 were the Common or Turpentine, Cole, Black, Long, No. 11, Apricot and Apple. The following have been advertised in the past: Alphonse, Banchore, Devambria, Green Mexican, Melachoton, Pirie, Yam. The Mango can be fruited under glass in the North. It requires a winter temperature of 60°.

The Mango tree is evergreen, grows 30–40 ft. high and makes a round, dense top (see Fig. 1361). The fls. are small and produced in terminal pyramidal panicles. A greenhouse specimen in England is said to have borne 108 panicles, each containing 2,100 fls., or a total of a quarter of a million fls. The Mango is presumably a native of the East Indies.

Mangoes in Jamaica.—The Mango was first known in the New World in Brazil, whence it was brought to Barbadoes in the middle of the eighteenth century. In 1782 a French vessel on its way to Haiti was captured by one of Rodney's squadron and brought as a prize to Jamaica; the collection of economic plants on board was deposited in the Botanic Garden. Many of the plants were new to the island, and amongst these was the Mango. It is said that the book containing the local names of the fruits was thrown overboard. The plants were numbered, and Nos. 11 and 32 have become famous varieties in the West Indies. The colored plate in the Botanical Magazine (4510) is supposed to represent No. 32.



1360. Mangifera Indica.

1361. Mangifera Indica.

In Jamaica it has become thoroughly naturalized and one of the commonest trees. In wet districts it is liable to cease fruiting after a few years, probably on account of its vigorous growth. It is recommended to treat it as one would other fruit trees in temperate climates in similar circumstances. Propagation is effected either by sowing the seed of good varieties or grafting from a good variety on strong seedlings. The fruit on trees grown from seed is not true to the parent in every case, but the percentage is so large that this has been the usual method employed. The kind of grafting employed is that known as grafting by approach or inarching. Any kind of soil suits it. Wm. Fawcett.

Mangoes in Florida.—The Mango deserves to be planted on well-protected land all over south Florida. The best soil is high, well-drained, sandy land suitable for oranges, but the Mango thrives also on black-jack, scrub and spruce-pine lands, where most other trees are a failure. Any good fertilizer will make the Mango grow, but for fruit use plenty of ashes or sulfate of potash beside the usual manure. In case of a hard freeze cut the trunk back at once to sound, live wood. The Mango tree is very handsome. The young growths are wine-colored. E. N. Reasoner.

Mangifera is a genus of 27 species according to the latest monographer, Engler in DC. Mon. Phan. 4: 195 (1883). They are all tropical Asian trees, their nearest ally of horticultural value being the Cashew, which is fully described under Anacardium. Lvs. alternate, stalked, leathery, entire: fls. polygamo-diœcious; calyx 4–5-parted; petals 4–5, overlapping, the middle nerve usually thickened; fertile stamens 1, or 4–5: style filiform.

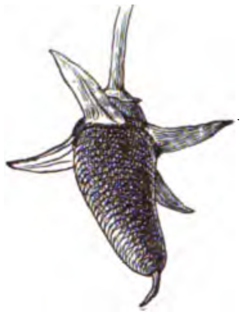
Indica, Linn. Mango. Figs. 1360–1. Lvs. thickish, 6–10 in. long, with about 15 pairs of lateral nerves: panicle longer than the lvs., densely covered with short, yellowish hairs: disk tumid (not minute), 4–5-lobed, wider than the ovary; petals inserted at the base of the disk, 5, rarely 4, with 1-5 veins, which are prominent on the upper side but scarcely so at the apex; fertile stamens 1-2, inserted at the base of the disk. B. M. 4510.

W. M.

MANGO. Consult *Mangifera.*

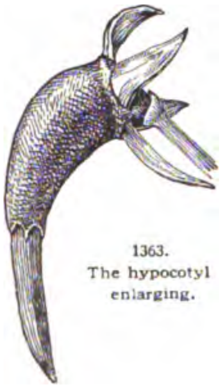
MANGOSTEEN. *Garcinia Mangostana.*

MANGROVE (probably an altered Malayan name) is a name applied to species of Rhizophora (Greek, *root-bearing*). The Rhizophoras are perhaps 5 or 6 in number, and are widely distributed on tropical shores. The genus gives name to the family *Rhizophoraceæ*, which Bentham & Hooker place in close relation to the *Combretaceæ* and *Myrtaceæ*. The common Mangrove, *R. Mangle*, Linn., is one of the commonest plants on the swampy shores of tropical and subtropical seas. It is not in cultivation, but its strange methods of propagation make it one of the most interesting of plants. The following account is reprinted from Bailey's "Lessons with Plants:"

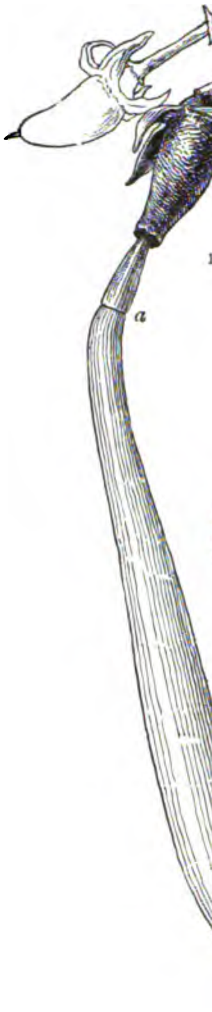


1362. The beginning of germination in the Mangrove.

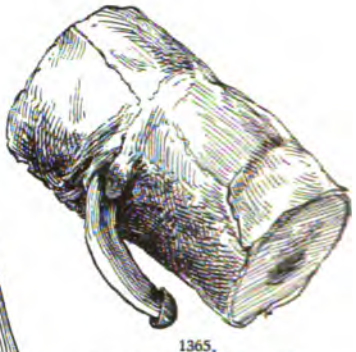
The Mangrove grows on the low shores of tropical lands. It extends as far north as the twenty-ninth parallel in Florida, and occurs at the mouth of the Mississippi and on the coast of Texas. It is a spreading bush, reaching a height of 15 to 25 feet upon the shores, but becoming a tall tree in various places. It is an important agent in the extension of land into the sea. The means by which this result is accomplished are two. The fruit is small and capsule-like, but does not fall from the tree at maturity. A fruit is shown natural size in Fig. 1362. The seed is germinating, sending its caulicle out through the apex of the fruit. In Fig. 1363 the germination is further progressed. In Fig. 1364, germination is nearly completed. The seed has endosperm. The cotyledons do not unfold in germination, but a woody tube grows from them and projects from the fruit to the point *a*. Inside this tube is the plumule. The hypocotyl continues to elongate, becoming thick and heavy at its lower end. When 6 inches or a foot long, it breaks away from the joint *a*, carrying the liberated plumule with it, and strikes root-end down in the mud. Roots push out from the lower end, and the epicotyl rapidly elongates and rears itself above the water. A piece of a Mangrove branch is shown natural size in Fig. 1365. An aërial root is pushing through the thick bark. The root makes a strong curve when it strikes off the branch, and then grows directly downward towards the water. The branch from which it springs may be only a few inches above the water, or it may be 10 feet; but the root pushes on until it inserts itself in the mud, and there makes a root system of its own. These long, lithe, descending roots (Fig. 1366), swaying in the wind, are characteristic features of the Mangrove swamp. Usually the hanging roots are unbranched, but now and then the tip breaks up into short branches (Fig 1367) before it reaches the water. These long roots remain attached at the upper end, and become trunks. The Mangrove plantation, therefore, becomes an interwoven mass, and thus marches on into the tidal rivers and the ocean, catching the flotsam and jetsam of the sea; and thereby it builds land and extends the shores. In the quiet recesses of the Mangrove swamp aquatic and amphibious life finds refuge. The shell-fish cling to the trunks and at low tide they are exposed, thus giving rise to the stories of the early explorers that oysters grow on trees. All this will recall the accounts of the banyan tree, and there are wild fig trees (the banyan is a fig) in Florida and southward which behave in a similar way. It seems strange that roots should strike out into the air, but the reader may have observed the "brace roots" near the ground on Indian corn; and many plants, as the ivy and trumpet-creeper, climb by means of roots.



1363. The hypocotyl enlarging.



1364. The hypocotyl nearly full grown.



1365. Aërial root of Mangrove.

MANIHOT (native Brazilian name). *Euphorbiaceæ.* About 80 species of perennial herbs or shrubs, with milky juice, occurring in tropical America, mostly in Brazil. Nearly always smooth and blue-green colored: lvs. alternate, entire or palmately lobed or divided: fls. large for the order, racemose or paniculate, terminal or axillary, monœceous; calyx imbricate in the bud, campanulate or radiate, often petal-like, 5-lobed; petals none; stamens few, in 2 whorls in the angles of the disk: capsules 3-celled, 3-seeded. Not much grown in greenhouses, except in forms of *M. palmata*. The economic species may do well in the tropical parts of the United States, where they are being introduced. According to Nicholson, they are best grown in peat loam and sand, and propagated by cuttings of young, rather fine shoots, rooted under a bell-glass in sandy peat, with bottom heat. The first species is grown in Florida, and all are procurable from southern California. The cultivation of Cassava is now attracting much attention in Florida.

Glaziòvii, Müll. Arg. CEARA RUBBER TREE. Lvs. long-petioled, peltate, deeply 3–5-palmately parted, or the upper entire; divisions entire, broad, ovate-lanceolate: fls. paniculate: bracts small. Brazil; extensively grown in Ceylon and India.—Its juice gives the Ceara rubber.

1366. The descending root.

utilissima, Pohl. CASSAVA, or MANIOC PLANT. BITTER CASSAVA. Figs. 1368–69. Roots fleshy, cylindrical, sometimes weighing as much as 30 pounds, and 3 ft. long, very poisonous: stems knotty, about 3 ft. high: lvs. long-petioled, not peltate, deeply 3–7-lobed; lobes lanceolate, entire: bracts small, entire: calyx glabrous outside, puberulent within, yellowish, 5-parted: filaments glabrous; anthers short: capsule and ovary distinctly wing-angled. July. Brazil. B.M. 3071.—Cultivated extensively in the tropics, where the Cassava made from the roots is a staple food. Tapioca is made from the root-starch by drying it in pellets on heated plates. The poisonous juice is pressed out in preparation or rendered harmless by heating.

palmàta, var. **Aipi,** Müll. Arg. (*M. Aipi*, Pohl). SWEET CASSAVA. Closely related to the last, but the root more reddish colored and non-poisonous: anthers elongated: capsule only angular above, not winged. Brazil.—Used as the last, but not so extensively.

J. B. S. NORTON.

1367. Multiple tips of a Mangrove root-branch.

The cultivation of Cassava is of the simplest description in the West Indies. A piece of the stem, 2 or 3 feet long, is planted in somewhat sandy ground and left to its fate, with occasional hoeing of weeds. In suitable soils in the driest parts of Jamaica, it produces enormous crops with little or no attention.

Ceara Rubber has not been cultivated in the West Indies to any extent, but it is like Cassava in its capability of growing in dry, sandy soil. It would probably yield more rubber if grown in districts where irrigation is possible.

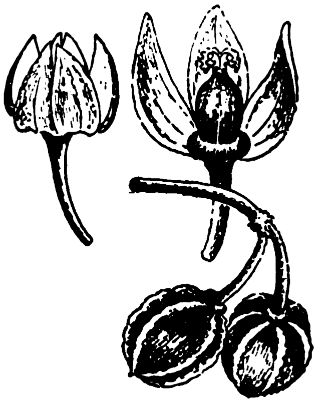
WM. FAWCETT.

MANITOBA. See *Canada.*

MANNA. See *Alhagi.*

MANNING, ROBERT (July 18, 1784, to Oct. 10, 1842), was one of the most thorough and accurate of American descriptive pomologists. In 1823 he established his "Pomological Garden" at Salem, Mass., for the purpose of collecting and proving varieties of fruits. At the time of his death this garden contained more varieties of fruits than had ever been collected in America. Pears were his specialty, but he had all the fruits which would thrive in his climate. These fruits numbered nearly 2,000 varieties, of which about one-half were pears. These varieties were gathered from all parts of this country, and also from Europe. The new pears of Van Mons, the Flemish scientist and propounder of a theory of plant variation (see "Survival of the Unlike," Essay V), were introduced largely by him. He also received valuable acquisitions from Robert Thompson, of the fruit department of the London Horticultural Society. In 1838, Manning published at Salem his "Book of Fruits, being a descriptive catalogue of the most valuable varieties of the pear, apple, peach, plum and cherry for New-England culture." It also contained bush-fruits, grape and hardy trees and shrubs. It was published as "First Series for 1838," which indicates that its author intended to issue other parts. All the descriptions were drawn from the fruits themselves. The book was well illustrated. In this work he was assisted by John M. Ives: and Ives made a second edition of the work in 1844 under the title "Book of Fruits," and a third in 1847 as "New-England Book of Fruits." At this day it is difficult to appreciate the work of a man like Manning. In those days, varieties were all-important. The scientific management of orchards had not yet arisen. Varieties were confused. Manning and his compeers opened the way for correct nomenclature and systematic pomology, and established the idea of testing varieties. His decisions on nomenclature were accepted as final. He was one of the founders of the Massachusetts Horticultural Society. For a reference to the position of Manning's work in our history, see the article *Horticulture;* also Tilton's Journ. Hort. 7, pp. 157–8. His son, of the same name, is secretary of the Massachusetts Horticultural Society.

L. H. B.



1368. Flowers and fruit of Manihot utilissima. Enlarged.

MAN-OF-THE-EARTH. *Ipomœa pandurata.*

MANURE (from old French *manurrer*, to cultivate by hand; Latin *manus*, hand, and *opera*, works). In the broadest sense, Manure is any substance applied to the soil for the purpose of increasing productivity. The excrements of animals, mixed or unmixed with straw or other absorbents, are usually spoken of as barn Manures. Commercial Manures or "fertilizers" are usually concentrated forms of nitrogen, potash and phosphoric acid, mixed or unmixed (see *Fertilizers*); green Manures are living plants plowed under to furnish humus and increase productivity; amendments are substances, such as lime, which may increase the growth and healthfulness of plants by improving the physical conditoin of the soil and by setting free unavailable plant-food. In general farming, barn Manures are usually applied in the raw or unrotted state; in horticulture, rotted or partially rotted. Horse Manure is used for hotbeds, while cow Manure, mixed with soil, is best for forming a moist, rich, potting earth. Dung, the solid voidings of animals, after weathering for a time, is also a valuable addition to potting earth. Florists often keep a number of dairy cattle that an abundant supply of bovine Manure, which is so valuable in floriculture, may be at hand. Commercial Manures are used in small quantities, either direct or in solution. Nitrogen stimulates the vegetative system and tends to produce rapid growth and dark foliage. Phosphoric acid, among other effects, has that of producing well-developed plump seeds and fruits; potash may augment these effects, as well as increase and intensify the color of the bloom.

1369. Manihot.
The plant whose roots produce tapioca.
(See p. 981.)

Barn Manures are more highly prized than formerly. Waste of their valuable constituents is now largely avoided either by applying them to the land day by day, as they are produced, or by more rational methods of caring for them until they are partly rotted or opportunity is afforded for most suitable application to the land. Covered yards or pits are now sometimes used for temporarily storing Manures, where they can have water added if too dry and if likely to "firefang;" or absorbents, such as straw, dry muck, gypsum and the like, may be used if they are too watery. When bedding is abundant, the animals may take their exercise in the covered yard, as they will solidify the Manure by tramping it, thereby diminishing loss by too rapid fermentation. Salt and gypsum both conserve plant-food in manures when spread over the mass from time to time in small quantities. The quantity and value of Manure made by domestic animals is not realized by those who allow it to be scattered over large, open barnyards or allow it to remain for considerable periods under the eaves of the barn. Extended experiments at the Cornell Experiment Station showed that the following amounts of excrements were produced daily for each 1,000 pounds of live weight of animal:

Sheep	34.1 lbs.
Calves	67.8 lbs.
Pigs	83.6 lbs.
Cows	74.1 lbs.
Horses	48.8 lbs.
Fowls	39.8 lbs.

Animals fed on a highly nitrogenous or narrow ration (as 1:4), as were the pigs in the above investigations, consume large quantities of water and produce a large amount of Manure, the weight of which often exceeds the amount of food consumed; while those fed on a carbonaceous or wide ration (as 1:9) consume comparatively little water and produce less weight of manure.

Some conditions affecting the production of Manure and its value may be stated as follows: If the plant-food value of Manure is computed at the price that is paid for the same constituents in fertilizers, it is found that the value of Manure produced by animals is equal to 30 to 50 per cent of the cost of their food. Young animals produce poorer Manure than mature ones. The excrements of animals which give a product, as milk or young, are poorer than those from non-productive animals. The more abundant the ration the less complete the digestion and the greater the value of the Manure produced. Concentrated and nitrogenous foods result in richer and more valuable excrements than unconcentrated or carbonaceous foods. Liberal salting and excessively succulent foods diminish the value of Manures. The amount and kind of bedding affect not only the quantity but the value per ton. Animals kept in cold quarters drink little water, digest their food closely and produce a Manure relatively small in amount and poor in quality.

Rich Manures are relatively more valuable per unit of contained fertility than poor ones. Plants are most benefiteb when they receive extra nourishment in the early stages of their growth. Coarse, low-grade Manures should be weathered or rotted to improve their availability, even though some loss may occur. A unit of plant-food in high-grade fertilizers or well-preserved, rotted Manures is worth more than in low grades. The valuable constituents in farm Manures are not so quickly available as they are in high-grade fertilizers, but they have an additional value, since they furnish humus, lighten the soil and increase its power to hold moisture, while assisting in liberating the mineral constituents of the soil. The value of Manure as set down below is determined by investigations during the winter months, and the nitrogen, phosphoric acid and potash are computed at 15, 6 and 4½ cents per pound, respectively. The indirect beneficial effects of Manure are considered an equal offset for the slightly less availability of their plant-food constituents as compared with fertilizers:

Kind of Manure.	*Value per ton.*
Sheep	$3 30
Calves	2 17
Pigs	3 29
Cows	2 02
Horses	2 21

Limited amounts of bedding were used in the tests from which the foregoing figures were made.

Kind of animal.	*Value per year.*
Fowls (1,000 lbs. of)	$51 10
Sheep " "	26 09
Calves " "	24 45
Pigs " "	60 88
Cows " "	29 27
Horses " "	27 74

Usually these animals are kept in the stables but half of the year, and inevitably some loss will occur, therefore it will be safe to estimate the recovered value per year at one-third to one-fourth of the above.

Heretofore the waste of the valuable constituents of Manures in the United States has been very great. Until recently, large, open barnyards have been the rule. In the northern and central parts of the United States the rainfall exceeds 30 inches per annum. Many barnyards contain from a quarter to half an acre. One inch of rainfall equals 113 tons of water per acre. If this be multiplied by thirty, a fairly accurate estimate is secured of the water which largely passes through or over the Manure and carries off its most soluble and hence most valuable constituents. The loss of value in Manures exposed at Ithaca, in loose heaps of from two to ten tons, during six months, was as follows:

1889.	Horse manure	42%
1890.	Horse manure	62%
1890.	Cow manure	30%
1889.	Mixed, compacted	9%

Even in horticulture, where a more liberal use of Manure than in general farming is admissable, too much reliance is often placed on Manures and too little on tillage. Manures may furnish plant-food, improve the physical condition of the soil, conserve and increase heat and moisture. Ten to twenty times as much food as the plants can utilize is sometimes applied. Growth and development are more largely determined by the amount of moisture than by the amount of plant-food. Five tons of preserved barn Manure contain of nitrogen, phosphoric acid and potash, 60, 30 and 45 pounds, respectively. Twenty-five bushels of wheat, with straw, contain 45 lbs. of nitrogen, 18 lbs. of phosphoric acid, and 27 lbs. of potash. Most soils contain large amounts of unavailable or difficultly available plant-food. Manures should be used largely to feed plants between the time the nutrients in the seed have been exhausted and that when the plants have secured a firm hold on the soil by manifold rootlets. Except where otherwise most suitable and convenient, barn Manures should be spread thinly in the autumn or early winter on the surface where plants are growing, thus imitating nature's methods of maintaining and increasing productivity. I. P. ROBERTS.

MAPÀNIA (aboriginal name). *Cyperàceæ.* Perhaps 6 or 8 described species in tropical countries, comprising strong perennial herbs, with broad and strong lvs. arising from the crown, and large fl.-clusters on mostly leafless scapes: the small, perfect fls. contain usually 6 hypogynous scales, usually 3 stamens, and 3 filiform stigmas: nutlet sessile, 3-angled. The only species in the Amer. trade is **M. pandanæfòlia,** Sander. Its nativity is not given, and it is possible that it does not belong to this genus (see Gt. 46, p. 522). The plant is represented as pandanus-like, 3–4 ft. high, with long, narrow, graceful, stiffish lvs. G.C. III. 21:349. Gt. 46, p. 523. In European garden literature, **M. lùcida,** N. E. Brown, and **M. hùmilis,** Vill. (from Malaya), are also described. Index Kewensis regards these species as one, *M. humilis* being the older name. It is an erect-growing plant with oblong strong-ribbed lvs., which are produced into long petioles and taper into long tail-like points. I.H. 32:557. It is also known as *Pandanophyllum Wendlandi*, Hort.

L. H. B.

MAPLE. See *Acer.* **Flowering M.**=*Abutilon.*

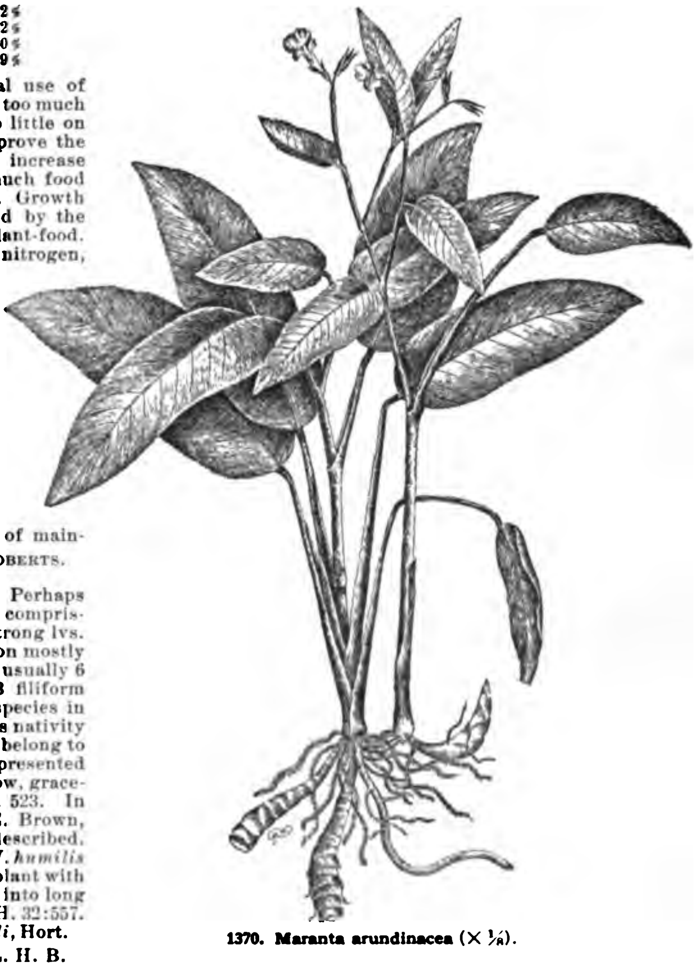
MARÁNTA (B. Maranta, Venetian botanist, died 1754). *Scitaminàceæ.* About 10 or 12 tropical American herbs, very closely allied to Calathea, but distinguished amongst other things by having 2 of the 3 locules in the fruit empty. Most of the plants cultivated as Marantas are Calatheas; and the true Marantas are treated the same as those plants. These plants are often named before the flowers are known, and some of the following plants may belong to the genus Calathea.

A. *Leaves green, pubescent beneath.*

arundinàcea, Linn Figs. 1370–71. Branched, 2–5 ft. high, tuberous: lvs. ovate-oblong and pointed: fls. white in an open cluster, the upper lip roundish. Trop. Amer. B. M. 2307.—One of the sources of arrow-root (see *Arrow-root*), the plant being often called Bermuda Arrow-Root. The starch is obtained from the roots. It thrives along the Gulf coast, although little cultivated. There is a form with leaves variegated green and yellow.

AA. *Leaves green, marked with strong, parallel light-colored bars extending from midrib towards margin or with a whitish central stripe.*

spléndida, Lem. Glabrous: lvs. 2 ft. or less long, large, oblong-lanceolate, with base subcordate or somewhat cuneate, short-acuminate at apex, above shining dark green and marked with pale green transverse bars, beneath violet-red. Brazil. I.H. 13:467–8.—By some regarded as Calathea (*C. splendida*, Regel). Resembles *Calathea Veitchiana*, but more robust.



1370. Maranta arundinacea (× ⅛).

AAA. *Leaves blotched or banded with dark colors (sometimes contrasted with silvery colors).*

undulàta, Lind. & André (properly *Calathèa undulàta*, Regel). Six to 8 in. high, compact: lvs. ovate-oblong, the blade about 4 in. long, subcordate and unequal at base, very short-pointed, the surface undulate, beneath purplish, above deep shining green, with a whitish feathery stripe through the center. Peru. I.H. 19:98.

leuconeùra, E. Morr. (*M. Kerchoveàna*, E. Morr. *M. Kerchòvei*, Hort. *Calathèa Kerchoveàna*, Hort.). Dwarf, 6–8 in.: lvs. cordate-oblong, usually obtuse or very short-acuminate, grayish green with oblong purple spots on either side of the midrib. Brazil. I.H. 26:353.

1371. Maranta arundinacea. (×½.)

Massangeàna, E. Morr. (*Calathèa Massangeàna*, Hort.). Larger in all its parts than the last: lvs. elliptic-ovate to obovate, rounded or truncate at base, the apex abruptly short-pointed, light purplish beneath, the upper part marked with three colors,—olive green towards the margin, broad central band of silvery gray, blotches of purple or maroon between the two. Brazil. F. S. 22:2364–5 (as *M. leuconeura*, var. *Massangeana*). J.H. III. 30: 499 (as var. *florentina*).

bicolor, Ker-Gawl. A foot high: lvs. roundish ovate, rounded or subcordate at the base, more or less wavy on the margin, abruptly short-pointed, light purple below, pale glacuous green above, with a relatively light-colored central band and very dark green or brown-green blotches midway between the rib and the margins. Brazil. B.R. 10:786. L.B.C. 10:921.

The following names are found in American trade-lists: *M. Baraquírii* = Calathea Baraquini ?—*M. Goveniàna*.—*M. iconífera*, Hort. (a form of Calathea Makoyana ?), has lvs. about 6 in. long, obliquely oval, yellowish green, with oblong, deep green spots or bars. Brazil.—*M. Lúbersi*. Foliage reticulated with yellow.—*M. musàica*, Hort. Lvs. 6–8 in. long, obliquely cordate, shining green, marked with many transverse veins. Brazil.—*M. Porteàna*. See Stromanthe.—*M. Sagoriàna*, Hort. Dwarf: lvs. oblong, pale green, with oblong-oblique, deep green bars on each side of the midrib. S. America.—*M. sanguínea*. See Stromanthe.

See Calathea for the following names: *albo-lineata*, *argyrea*, *Bachemiana*, *Chimboracensis*, *eximia*, *fasciata*, *Fascinator*, *illustris*, *Lageriana*, *Legrelliana*, *Lietzii*, *Lindeni*, *Makoyana*, *medio-picta*, *micans*, *nitens*, *ornata*, *princeps*, *pulchella*, *regalis*, *roseo-lineata*, *rosea-picta*, *smaragdina*, *tubispatha*, *Vandenheckei*, *Veitchiana*, *virginalis*, *Wagneri*, *Warscewiczii*, *Wioti*, *zebrina*.

L. H. B.

MARÁTTIA (name from J. F. Maratti, an Italian botanist of the seventeenth century). *Marattiàceæ*. A genus of large, coarse-leaved fern-like plants with the sporangia borne in large, boat-shaped conceptacles on the under surface of the leaf. The species are strong-growing and ornamental, some of them reaching considerable size.

fraxinea, Smith (*M. élegans*, Endl.). Lvs. bipinnate, 6–15 ft. long, on stalks often 1 in. or more thick; pinnules 4–6 in. long, ½–1½ in. wide, of a leathery texture and naked surfaces: receptacles submarginal. West Africa to Malaysia and New Zealand.

L. M. UNDERWOOD.

MARCGRÀVIA is a genus of Ternströmiaceæ, but *M. paradoxa* = *Monstera acuminata*.

MARCHÁNTIA (Nicholas Marchant, French botanist). *Marchantiàceæ*. A common liverwort, spreading its leaf-like forking thallus on moist earth. **M. polymórpha**, Linn., has been offered by dealers in native plants, the sods of it being sold for colonizing in rock gardens. It often grows on damp sills and walls in greenhouses. The flat thallus is often 4–5 in. long and 1 in. or more wide, from which rise peduncles 1 in. high, bearing the antheridial disk or shield and the star-like carpocephalum on similar stalks 1–3 in. high.

MARGUERITE or **PARIS DAISY** is *Chrysanthemum frutescens*. **Blue Marguerite** is *Felicia amelloides*. **Reine M.**, of the French, is *China Aster*.

MARGYRICÁRPUS (Greek, *pearly fruit;* referring to the white berries). *Rosàceæ*. Five species of South American subshrubs, of which *M. setosus* is a heath-like plant cult. in rockeries for its numerous small white berries, which are seen to best advantage against dark background. The nearest genus of garden value is Acæna, which has fls. in heads, while those of Margyricarpus are solitary and axillary. Branching shrubs with inconspicuous fls. which are sessile and have no petals. Lvs. alternate, crowded, overlapping: calyx tube persistent; lobes 4–5: ovules solitary, hanging from the top of the cell.

setòsus, Ruiz & Pav. Low-growing. Peru, Chile.—Int. by Franceschi. Hardy in England. Sometimes called Pearl Fruit.

MARÌCA (meaning doubtful; the author of the genus did not explain). *Iridàceæ*. Eleven species of tropical American plants allied to Iris, but with shorter-lived flowers and convolute inner segments. Three species are procurable from Dutch dealers. The fls. are 2–4 in. across, the outer segments large, white or blue, the inner ones smaller, with complicated and beautiful coloring. They are planted in the fall, and are hardy with winter covering. The genus is nearest to Cypella, but the style crests are petal-like, while in Cypella they are spur-like or flattened. Rootstock a short rhizome: lvs. sword-shaped, 2-ranked: fls. blue, yellow or white. Baker, Irideæ, 1892.

A. *Outer segments pure white.*

grácilis, Herb. Lvs. 1–1½ ft. long, ½–1 in. broad: fls. 2 in. across. B.M. 3713.

AA. *Outer segments white, marked at the base with brown and yellow.*

Northiàna, Ker. Lvs. 1½–2 in. broad: fls. 3–4 in. across. B.M. 654. I.H. 42:40 (var. *splendens*).

AAA. *Outer segments blue.*

cærùlea, Ker. Lvs. 1–1½ in. broad: fls. 3–4 in. across. B.M. 5612 (as *Cypella cærulea*). B.R. 9:713. Gn. 25, p. 313. K.W. 1:40.

M. Califórnica. See Sisyrinchium.

MARIGOLD. The oldest kind is the Pot Marigold, the dried fls. of which are used to season soups. It is also cult. for ornament. See *Calandula officinalis*. The **French Marigold** is *Tagetes patula;* the **African**, *T. erecta*. The African Marigolds are mostly pure lemon- or orange-colored; the French ones have these colors and brown also, and are often striped. For **Cape Marigold**, see *Dimorphotheca*. For **Fig Marigold**, see *Mesembryanthemum*. **Marsh Marigold** is *Caltha palustris*.

MARINE IVY. *Cissus incisa.*

MARIPOSA LILY. See *Calochortus*.

MARIPOSA TULIP. *Calochortus*.

MARJORAM, SWEET. *Origanum*.

MARKERY, MERCURY. See *Chenopodium*.

MARROW, VEGETABLE. See *Pumpkin*.

MARRÙBIUM (old Latin name of obscure meaning). *Labiàtæ*. A genus of about 40 Old World species, including the common Horehound, a hardy, perennial, bitter-aromatic herb, growing 1–3 ft. high, with whitish, hairy, crenate lvs., and axillary whorls of small whitish fls. It is a native of Europe, Asia and northern Africa, now found as an escape from gardens in waste places of nearly every country of the world. Horehound is used in large quantities for confections and medicines for coughs and colds.

Marrubium comprises similar perennials branched from the base, with wrinkled and crenate or cut lvs., and many-fld. axillary whorls of small white or purplish fls.: calyx tubular, 5–10-nerved and with 5 or 10 awl-shaped teeth.

vulgàre, Linn. COMMON HOREHOUND. Height 1–3 ft.: stems ascending: lvs. ovate, stalked: calyx with 10 recurved teeth, the alternate ones shorter: fls. white. Summer. B.B. 3:84.

Horehound (or Hoarhound) in America has become a common weed in New England, Indiana and upon the Pacific coast, especially south of San Francisco. From the last region is obtained Horehound honey, a product considered useful in the treatment of coughs and colds. The leaves and tops have a bitter, penetrating taste and a strong, not unpleasant odor, which is somewhat dissipated by drying. In addition to its well-known uses in pulmonary troubles, it is credited with tonic, laxative and, in domestic medicine, deobstruent properties. The plant prefers a dry, warm, rather rich, light soil. It may be readily propagated by division of the clumps or by seed sown in the spring where the plants are to remain. The drills should be 2 feet apart and the plants 1 foot asunder. With clean cultivation and moderate annual manuring two abundant cuttings should be obtained each year. Since the market is fully supplied by the wild plants and since, when once established, it will grow almost spontaneously, the cultivation of Horehound is not recommended except to supply private needs.

M. G. KAINS and M. B. COULSTON.

MARSDÈNIA (William Marsden, 1754–1836, wrote a history of Sumatra). *Asclepiadàceæ.* About 50 species of tropical and subtropical shrubs, mostly twiners, of which about half a dozen species are cult. in Europe under glass. *M. Roylei*, a fiber and dye plant from the East Indies, was introduced by Reasoner in 1889, but is now lost. The genus is allied to Stephanotis, which has large white fls., while those of Marsdenia are usually purplish, lurid, greenish or pallid. Lvs. opposite: cymes umbel-shaped, simple or branched, terminal or axillary: calyx 5-parted: corolla bell-, urn- or salver-shaped; lobes narrow or broad, overlapping to the right: crown of 5 scales: seeds comose.

Róylei, Wight. Lvs. 3–6 in. long, 2–4 in. wide, ovate cordate, acuminate, pubescent or tomentose beneath; petioles 1½–2 in. long: cymes 1–1½ in. across: fls. 3–4 lines in diam.; corolla somewhat bell-shaped; lobes large, fleshy; stigma not extended beyond the anthers: seeds ½ in. long.

L. H. B.

MARSHÁLLIA (Humphrey Marshall, wrote Arbustum Americanum, 1785, the first American work on our trees and shrubs; also founded one of the first American botanic gardens). *Compósitæ.* About 9 species of perennial North American herbs, of which only one species, *M. cæspitosa*, seems to have been offered. Marshallias are tufted plants, growing about a foot high, with entire lvs. and scapes bearing solitary rayless heads about 1½ in. across. Somewhat like the common Scabious. These are rose-purple or white, with blue anthers, and appear in spring or summer. For fuller description, see our manuals.

cæspitòsa, Nutt. Tufted, glabrous: lvs. spatulate-linear; upper ones linear: bracts of the involucre linear: disk-fls. pale rose or white: seeds inversely pyramidal, villous on the angles. Limestone soil, Ark. to Tex. B.M. 3704. B.B. 3:443.

MARSH MALLOW. *Althæa officinalis.*

MARSÍLEA (Giovanni Marsigli, Italian botanist of last part of the eighteenth century, or Aloys Ferd., Graf von Marsigli, 1658–1730). *Marsileàceæ.* Aquatic flowerless plants (about 40 species), with lvs. like 4-leaved clover or oxalis, one species of which, *M. quadrifolia*, Linn., is sold and is also run wild in the eastern states. It is a creeping plant, rooting in the mud on the margins of ponds and making an attractive cover. The petioles grow 3–5 in. tall, or taller in the water, and bear at the apex 4 bright green obcuneate or triangular leaflets. The sporocarps or fruits are nearly sessile at the base of the petioles. Prop. easily by pieces of the runners, and is likely to become a weed. The young leaflets close at night. Europe and Asia. Mn. 6, p. 107.

MARTINÈZIA (Rev. Dr. Baltasar Jacobo Martinez Companon, archbishop of Santa Fé, who sent many early collections of plants from Peru). *Palmàceæ.* Ornamental palms, with spiny ringed trunks: lvs. pinnate, the segments broad, wedge-shaped, alternate or grouped, the apex truncate and ragged: petioles and rachis spiny, as are also the spadices and spathes of the inflorescence: fls. rather small: fr. globose, 1-celled, orange, scarlet or rose-pink. Species 7. Trop. Amer.

JARED G. SMITH.

Martinezias are beautiful palms, and make fairly good house plants. They must have a stove temperature. They do not require a great amount of soil. Light sandy loam, with plenty of sharp sand, is best. They need abundant moisture. They sometimes flower in cultivation, but the 4 kinds given below are distinct by their foliage and spines. Like all armed palms, they are slow to germinate, but after the first or second year they grow fairly fast. The commonest and best kind is *M. caryotæfolia*, which has fewer spines than the other species and, unlike many other palms, shows its true lvs. at a very early stage. It resembles the fish-tail palms (Caryota), but the lvs. are a lighter green and generally larger. *M. erosa* makes a better specimen at 5–6 ft. than when small. It is much more jagged at the tips of the lvs. Being very spiny all over, it is less desirable. *M. Lindeniana* is more like the first. The spines are longer but not very numerous. *M. Granatensis* is of coarser habit and slower growth, and desirable only for large collections.

H. A. SIEBRECHT.

A. *Lvs. divided into segments.*

B. *Segments in groups.*

C. *Apex of segments 3-lobed.*

caryotæfòlia, HBK. Stems at length 30 to 50 ft. high: lvs. few, 3–6 ft. long, light green; lfts. in groups, 6–12 in. long, 4–6 in. wide at the apex: stem, petioles, rachis and nerves below, densely clothed with long black spines. Colombia. G.C. 1872:181. B.M. 6854. F.R. 2:49.

CC. *Apex of segments with a point projecting from the upper margin.*

Lindeniàna, H. Wendl. Stems 9–15 ft. high: pinnæ in opposite groups of 4 to 6, the groups widely separated, long-wedge-shaped, 10–14 in. long, 8–10 times as long as broad, with a short, projecting point at the upper margin, the nerves ciliate-spiny toward the end: petiole densely covered with grayish brown hairs, with many rather large black spines 1–2½ in. long: rachis is also spiny above and below: midnerve of each segment a trifle shorter than the lower margin and spiny beneath, like the rachis and lateral nerves: lvs. dark green above, lighter beneath; terminal segment broadest: fr. rose-red. Mountains of Colombia, at an altitude of 6,000 ft.

BB. *Segments in 2–4 pairs.*

eròsa, Linden. Lvs. with 2–3 pairs of narrow lfts. at base and a pair of broader ones at the apex, all oblique at the apex, bearing long, brown, needle-shaped spines on the veins and midrib: rachis cylindrical or obtusely angled, mealy, clothed with spines like those on the lvs. West Indies. G.C. 1872:1297.

AA. *Lvs. bifid at the apex.*

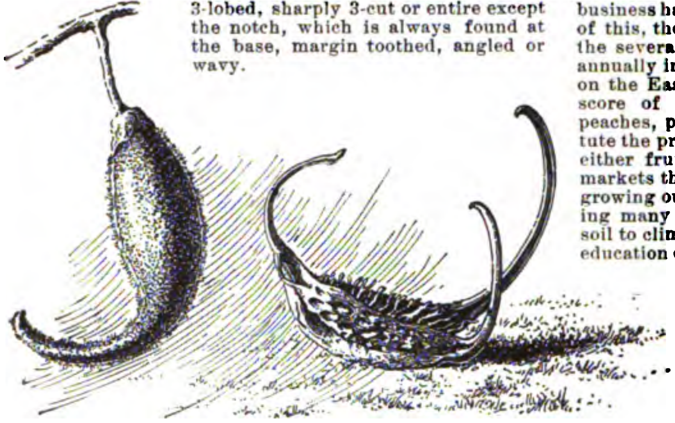
Granaténsis, Hort. (*M. Granadénsis*, Hort.). Lvs. roundish oblong or roundish ovate, entire at the base, bifid at the apex, evenly toothed along the edges: petioles and rachis with dark brown, needle-shaped, spreading or reflexed spines, ⅓–1 in. long. Colombia.

JARED G. SMITH.

MARTỲNIA (John Martyn, 1699–1768, professor of botany at Cambridge, botanical author and editor of the largest edition of Miller's "Gardeners' Dictionary"). *Pedaliàceæ.* About 10 species of coarse annuals from the warmer parts of America, a few of which are cult. for pickles or for ornament. They have large showy fls. much like those of Catalpa in form, the 2 upper lobes being smaller than the 3 lower. The fls. are 2 in. or more across, chiefly lilac, purple or yellow but spotted and marked about the throat with other colors. They are heavily scented and interesting, but, like all other parts of the plant, they are clammy. The plants grow 1½ ft. or more high, and should be started in a hotbed in early spring in the North and transplanted to the open. In the middle and southern states seed may be sown in the open 3 ft. apart each way where the plants are to remain. The capsules are taken when small and tender and pickled like cucumbers. They have a very distinct appearance by reason of the long-curved horn which splits from the top as the capsule hardens.

The small family to which Martynia belongs is allied to the Bignonia family, and the fls. are much alike, but the habit and fruit are different. Martynias are either annuals or perennials, with large tuber-shaped roots, prostrate or suberect and clammy: lvs. opposite or alternate, long-stalked, cordate, coarsely wavy-margined or toothed, or palmately lobed: fls. 5–8 in a short, terminal raceme: capsules with 2 short or long horns.

The first three species described below belong to the subgenus Proboscidea, which has 4 perfect stamens and long-horned capsules. They vary considerably in the foliage, roundish or wider than long, 3-lobed, sharply 3-cut or entire except the notch, which is always found at the base, margin toothed, angled or wavy.



1372. Martynia proboscidea (× ⅓).

A. *Fls. lilac or dull white.*

proboscídea, Glox. (*M. Louisiàna*, Mill.). UNICORN PLANT. PROBOSCIS FLOWER. Fig. 1372. Lvs. roundish, often oblique, entirely obscurely wavy-lobed, 4–12 in. wide: fls. also vary to light yellow. Banks of Mississippi; nat. near old gardens. B.M. 1056. V. 3:151.—The picture (Fig. 1372) shows fruits one-third the size at full maturity. The right-hand specimen shows the woody part, after all the soft parts have been macerated.

AA. *Fls. purple.*

fràgrans, Lindl. (*M. formòsa*, Vilm.). Less stout than *M. proboscidea:* lvs. roundish to oblong-cordate, somewhat lobed and wavy-toothed, 3–5 in. broad. Mex. B.M. 4292. B.R. 27:6. R.H. 1843:248.

AAA. *Fls. yellow.*

lùtea, Lindl. Lvs. cordate-orbiculate, subdentate, glandular-pubescent. Brazil. B.R. 11:934.

AAAA. *Fls. white.*

Craniolària, Glox. Properly *Craniolària ánnua*, Linn., a genus distinguished by having a very long and slender corolla tube, while in Martynia the corolla tube is swelled out at a very short distance from the base. Lvs. palmately lobed; margins dentate: corolla tube about 6 in. long. Colombia.—Some of the plants sold under this name are *M. proboscidea;* others are *M. fragrans*.

W. M.

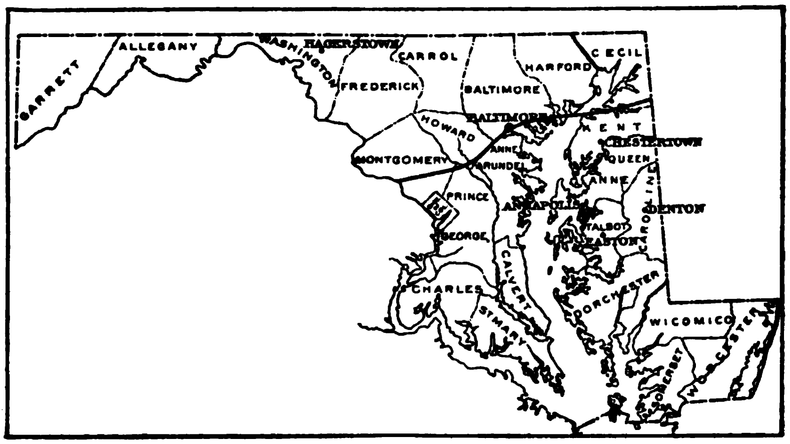
MARVEL OF PERU. *Mirabilis Jalapa.*

MARY, BLUE-EYED. *Tradescantia Virginica.*

MARYLAND, HORTICULTURE IN. Fig. 1373. All of this state lying south of Baltimore possesses notable horticultural possibilities. The lands are quite variable in composition, and are very sensitive and responsive to judicious and rational treatment. In the production of early fruits and vegetables, the natural adaptability of soil, the mild and equable temperature resulting from the influence of the expansive waters of the Chesapeake bay, which cuts the state in two, as well as from geographical location and convenient access to all the principal eastern city markets, are the conditions which combine in a presentation of rare inducements that are not fully appreciated by the rural citizenship of the locality. Fully three-fifths of the farms in Maryland, by circumstances as above briefly indicated, are specially adapted to horticultural pursuits. The eight counties forming a tier, extending from east to west along the northern boundary of the state, do not enjoy so wide a range in horticultural favor as the central and southern counties. The wonderful development of the fruit and vegetable packing or canning industry in the state is to a very noticeable degree encouraging, and accomplishing a diversification for the promotion and betterment of horticulture. In the city of Baltimore the "packing" business has assumed huge proportions, but independent of this, the business has in the aggregate, throughout the several counties, reached a large volume, which is annually increasing. Caroline county, centrally located on the Eastern Shore, annually operates more than a score of such houses. Strawberries, blackberries, peaches, pears, peas, tomatoes and sweet corn constitute the principal articles canned. No fancy prices for either fruits or vegetables are obtained in the local markets thus created, but a great good to horticulture growing out of these operations is that they are inducing many hard-worked and poorly paid tillers of the soil to climb out of the old ruts, giving them a practical education or training that enables them to grow and prepare products for the city markets in keeping with modern demands. Thousands of acres in this state are now devoted to peas, tomatoes and sweet corn for the packing houses. Summarized, this means more manure—better methods—better land.

For many years the peach maintained undisputed supremacy in the fruit interests of Maryland. Enthusiasm extended the acreage beyond the capacity for proper care and culture, thus inviting the encroachment of disease and insect enemies to an extent that has served to circumscribe the misdirected ambition for large orchards, and has robbed peach-growing of much of its fascination. In the aggregate, the orchard acreage is still immense; but old orchards are going out to a much greater extent than new ones are being planted. In the northern tier of counties, interest in apple-growing is increasing. Cherries, too, in many locations in this part of the state are successfully grown. Pears are more generally grown and satisfactory throughout the state than cherries. Kent and Queen Anne counties, of the Eastern Shore, excel in the production of pears, both in quantity and quality. Plums of the native and Japanese species receive considerable attention, and in many instances prove more remunerative than other fruits. Small fruits of all kinds are grown in great abundance. The large fruit interests of the state create and maintain a large local demand for nursery stock, which is shared by the forty nurseries in various parts of the commonwealth. Several of these establishments make the propagation of peach trees a specialty, growing them by the hundreds of thousands, and disposing of them in a wholesale way to their fellow-nurserymen in localities less favored for propagating these trees. In a few of the Western Shore counties tobacco still figures to some extent in soil products; on the Eastern Shore tobacco has been superseded largely by sweet potatoes, to the decided benefit of both land and landlord.

The division of the state by the Chesapeake bay keeps the Eastern Shore out of touch in more ways than one with the rest of the state. The experiment station is located on the Western Shore, where the horticultural interests are on lines more or less distinct from those on the Eastern Shore. Greater harmony obtains between the conditions of the Eastern Shore and of Delaware; hence it naturally follows that horticultural relations between the Eastern Shore of Maryland and the state of Delaware are closer and more intimate in many respects than those between the two "shores" of Maryland, and doubtless will remain so unless counteracted by the establishment of an active and well-equipped sub-station on the Eastern Shore. The entire peninsula, comprising Delaware's three, Maryland's nine and Virginia's two counties, should properly constitute one state, as nature seems to have intended. If these fourteen peninsula counties were banded together by the ties of statehood, and thus governed solely by their own citizens, it could not do otherwise than promote and accelerate the progress in horticultural advancement, and make it by concentrated art and practice what it is by nature, America's Eden. It is capable of supporting a population ten times as large as at present inhabits it, with an overflow sufficient to feed five times as many more in the large near-by cities with choice fruits and vegetables, easily grown in endless variety.



1373. Maryland. The strong line sets off the horticultural regions to the south.

Maryland's metropolis, with its rapidly improving facilities for distributing to other cities and towns, affords much encouragement and gives impetus to all horticultural operations. Baltimore market is the main dependence of the Western Shore and western Maryland fruit-growers and truckers; while a large share of the horticultural products of the Eastern Shore, owing to convenient accessibility, are consigned to New York, Philadelphia and Wilmington. The General Assembly or Legislature of Maryland has never, until quite recently, done anything to promote or protect, by appropriation or otherwise, the great horticultural interests of the state, while it has expended hundreds of thousands of dollars to exploit and protect the oyster and fish industries. The value of the small-fruit crop reaches into millions of dollars annually. Add to this the peaches, pears, apples, plums, cherries, etc.—then couple to all the vast volume of vegetable production throughout the state—grasp all this, and crowd it into the two words—*horticultural interests*, and here are the data in the form of unmanufactured material, and the nearest approach to synthetical statistics that is available. That horticulture takes rank with the greatest industries of the state is obvious to any unclouded comprehension. The soil of fifteen of the twenty-three counties comprising the commonwealth, reveals unmistakable evidence that nature, in loving pride, planned a brilliant horticultural destiny for them, holding out conspicuously, among numerous other incentives, a climate promotive of health, pleasure and prosperity. Violent extremes of heat and cold, so troublesome, annoying, and even disastrous in many other sections, are rarely if ever experienced here. Industrial evolution is steadily giving trend toward higher development of horticulture in the state.

J. W. KERR.

MASDEVÁLLIA (Joseph Masdevall, a Spanish physician and botanist). *Orchidàceæ*, tribe *Epidéndreæ*. Masdevallias are inhabitants of the American tropics. There are more than 150 species, and various hybrids and garden forms. They are not showy orchids, but are odd and often grotesque. The petals are small and usually hidden in the calyx-tube, but the 3 calyx-lobes are greatly developed and give character to the flower. Often these lobes end in slender tails several inches long. Lip of the corolla short, articulate with the base of the winged or wingless column, in some species sensitive. Pollinia 2, without caulicles. The Masdevallias have no pseudobulbs; the leaves are variable in size, oblong to linear, thick, sheathing at the base; the peduncles bear from 1–5 or more flowers. The species of the *M. coccinea* group are relatively simple in form, but are usually prized for their brilliant coloring. Those of the *M. Chimæra* group are remarkable for their fantastic shapes. Of late years many new kinds have been introduced, and the genus is somewhat confused as to the specific limits of the various forms. Masdevallias are polymorphous, and herbarium specimens do not show specific characters well. See "The Genus Masdevallia," by Florence H. Woolward (1896).

L. H. B.

Masdevallias are found growing at high elevations, ranging from 6,000 to 12,000 feet above sea level, in northwestern South America and Central America, with a few sparingly distributed elsewhere over tropical America. These regions are generally subjected to two rainy seasons annually, often with very short intermissions. The atmosphere, though somewhat rarified, is very humid, the temperature in the shade seldom rising above 65° F., and often dropping to 40° in some districts. Heavy fogs are frequent, especially in the forepart of the day, and during the greater portion of the year the under-vegetation is in a saturated condition; the high winds prevalent in these districts, however, counteract to a great extent any evil influence which might otherwise arise from it.

The heat of our summer makes it quite impossible to imitate wholly the above conditions, but with a proper house, such as is afforded Odontoglossums of the crispum section, very satisfactory results may be obtained and the many species will be found of comparatively easy culture. A low, well-ventilated, half-span house of northern exposure, with an upright stone or brick wall on the south side, is best adapted to them. The house should be provided with canvas roll-shading, supported on a framework elevated 15 or 18 inches above the glass in order that the cool air may pass freely beneath it. This will help to guard against solar heat during summer. Houses built partly below ground are not to be recommended, as the atmosphere soon becomes stagnant and inactive, causing the leaves to fall prematurely. Where it is convenient, solid beds are preferable; benches, however, will answer the purpose very well, and when used should be covered about 2 inches deep with sifted ashes, sand or gravel; the benches and floors should be hosed down once or twice daily to afford all the cool moisture possible.

In winter the temperature should range between 50° and 55° F. at night and about 60° during the day or 5° more on mild days, with weak solar heat and ventilation. Artificial heat must be dispensed with as early in spring as possible, and during summer the temperature kept as low as the weather will permit, ventilating freely, especially at night, when a light syringing overhead will also prove beneficial. Midday syringing in hot weather is often injurious and should be done with caution if at all. More benefit will result from hosing down the shelves and paths at intervals of three or four hours, as it will help to reduce the temperature.

Masdevallias need a great deal of water at the roots at all seasons, and the soil should never be allowed to dry out, as they have no fleshy pseudobulbs to protect them against extreme changes. Light syringing overhead during winter and spring in fine weather will assist in checking thrip and red spider, and a weak solution of tobacco may be added with good effect.

The best season for repotting and basketing the plants is during November and December, and the best general compost is a mixture of clean peat fiber and sphagnum moss chopped rather fine and well mixed, some sections requiring in addition a portion of chopped sod. About one-third of the space should be devoted to clean drainage consisting of either broken charcoal or potsherds.

M. coriacea, elephanticeps, Peristeria, Reichenbachiana, and kindred species, grow best in small pots, and should have one-third chopped sod added to their potting compost. *M. macrura, Schlimii, Tovarensis, amabilis, coccinea, Veitchiana, triangularis, polysticta, muscosa*, and the numerous other allied species, grow equally well in either pots or baskets, but should the latter be used it would be well to add a small portion of chopped sod to the compost to make it more firm and less porous; the sod has a cooling effect on the roots. *M. bella, Carderi, Chestertoni, Chimæra, Houtteana* and their allies nearly all have pendulous flower-scapes, and should be suspended from the roof in baskets in a compost of equal parts chopped peat-fiber and live sphagnum, with a little leaf-mold added. The flower-scapes often penetrate through the compost; for this reason little or no drainage should be used, as it may retard their progress.

To increase the stock the plants must be divided during the early winter; this will give them a chance to reëstablish themselves before the following summer. They must not be broken up into too small pieces, as it has a tendency to weaken them. Cult. by R. M. Grey.

Review of the Sections.

Section I. Scape 1-fld.: calyx-tube rather narrow, tubular or somewhat funnel-shaped: labellum plane.............................Species 1–7
Section II. Scape 1-fld.: calyx-tube broad, gibbous or basin-like: labellum plane.....Species 8–24
Section III. Scape several-fld.: labellum plane and narrow ....Species 25–37
Section IV. Scape mostly 1-fld., pendent or suberect: labellum saccate, or at least much broadened: tails very long...................Species 38–44
Section V. Scapes 1-fld. This section differs from all the others by the subterete lvs., and in having the tails inserted below the apex of each lateral sepal ....Species 45

INDEX.

abbreviata, 26.
amabilis, 4.
atrosanguinea, 7.
Armeniaca, 7.
Backhousiana, 38.
Barlæana, 6.
bella, 43.
Boddærti, 2.
caloptera, 29.
calura, 17.
Carderi, 40.
Chestertoni, 41.
Chimæra, 38, 42.
civilis, 11.
coccinea, 7.
cœrulescens, 7.
Crossii, 33.
conchiflora, 7.
coriacea, 10.
corniculata, 13.
Davisii, 5.
Denisoni, 7.
elephanticeps, 24.
Ephippium, 32.
Estradæ, 19.
grandiflora, 1, 2, 7
Gravesiæ, 7.
Harryana, 7.
hieroglyphica, 22.
Houtteana, 39.
ignea, 2.
inflata, 13.
infracta, 37.
ionocharis, 15.
leontoglossa, 9.
Lindeni, 7.
lineata, 4.
macrura, 14.
maculata, 36.
Massangeana, 2.
melanopus, 28.
militaris, 2.
Mooreana, 24.
muscosa, 25.
nidifica, 16.
nycterina, 42.
pachysepala, 24.
pachyura, 30.
pallida, 20.
Peristeria, 12.
platyglossa. 8.
polysticta, 27, 28.
psittacina, 39.
racemosa, 33.
radiosa, 44.
Reichenbachiana, 35.
Rœzlii, 38.
rosea, 3.
rufo-lutea, 11.
Schlimii, 34.
Shuttleworthii, 18.
striata, 4.
superba, 2.
Tovarensis, 31.
triangularis, 21.
triaristella, 45.
trochilus, 32.
Veitchiana, 1.
Wageneriana, 23.
Wallisii, 38.
Winniana, 38.
xanthocorys, 18.
xanthina, 20.

SECTION I.

A. *Calyx-lobes glandular with minute papillæ* .... 1. **Veitchiana**
AA. *Calyx-lobes not glandular.*
B. *Tail of the dorsal lobe hanging forward*.............................. 2. **militaris**
3. **rosea**
BB. *Tail of the dorsal lobe erect and straight*.............................. 4. **amabilis**
5. **Davisii**
6. **Barlæana**
BBB. *Tail of the dorsal lobe reflexed and flexuous*.............................. 7. **coccinea**

1. **Veitchiàna**, Reichb. f. Tufted: lvs. 4–6 in. long, narrow: peduncle erect and slender, 1 ft. or more, with 2 or more bracts (the upper one remote from the flower): calyx with bell-shaped tube, the expanding lobes 3 in. across, orange-red, with purple shades, glandular-hairy, abruptly contracted into short, narrow tails; petals white, hidden. Peru. B. M. 5739. — Var. **grandiflòra**, Hort., has a dense hairy covering on the dorsal lobe of calyx; and also on the outer part of the lateral lobes, the inner part orange-scarlet.

2. **militàris**, Reichb. f. & Warscz. (*M. ignea*, Reichb. f.). Much like the last, but differs in having elliptic or elliptic-obovate lvs., which are long-petioled, and in the lateral calyx lobes being only prominently pointed, not tailed, the dorsal lobe very narrow and hanging forward between the other two: color orange and scarlet; petals white, exceeding the column. Spring. Colombia. B. M. 5962. I. H. 26:333. — Var. **Massangeàna**, Hort. Lateral lobes longer: fls. larger. Var. **Bóddærti**, Hort. Calyx yellow; lower lobes shaded with red on the upper surface. I. H. 26:357. Var. **grandiflòra**, Hort. Fls. rounded; lateral sepals brilliant vermilion, bordered with crimson and suffused with purple. Var. **supérba**, Hort., is advertised.

3. **ròsea**, Lindl. Lvs. oblong-spoon-shaped, keeled: peduncle drooping and slender, bearing a single fl.: calyx tube 1 in. long, red and violet; calyx-lobes rose-lilac, with red tails; petals yellow, the lip hairy at the apex. Ecuador. G.C. III. 16:657. July, Aug.—A pretty and free-flowering species.

4. **amábilis**, Reichb. f. & Warscz. Lvs. 4–5 in. long, oblong- or spatulate-lanceolate, about half the length of the erect, usually 1-fld. peduncles: fls. varying from purplish crimson to yellow; lobes ovate-triangular, the lateral ones with short tails and the dorsal ones with a long and ascending tail; petals narrow, yellowish, longer than the column. Peru. Sept.–Dec.—Var. **lineàta**, Linden & André (var. *striàta*, Hort.), has yellowish fls., tinged and striped with red. I.H. 22:196.

5. **Dàvisii**, Reichb. f. Densely cespitose: lvs. oblong-lanceolate, 6–8 in. long, petioled, blunt at the apex: peduncle erect, about 10 in. long: calyx large, brilliant yellow, obscurely veined with deeper yellow; dorsal lobe triangular-ovate, prolonged in a tail; lateral lobes oblong-ovate, larger, united to below the middle, terminating in short tails; petals longer than the column, nearly hidden in the calyx-tube, pale yellow, the labellum yellow, shaded and spotted with red, with 2 obscure keels. Peru. B.M. 6190.

6. **Barlæàna**, Reichb. f. Lvs. spatulate, acute: peduncle slender, nearly 1 ft. long: fls. scarlet; calyx-tube curved; dorsal sepals short-triangular, produced into a long tail; lateral sepals larger, semi-ovate; petals ligulate, white. Peru.—Reichb. states that the lateral sepals run internally one in another; they are connate in a straight line.

7. **coccínea**, Linden (*M. Lindeni*, André). Fig. 1374. Lvs. spatulate, obtuse or retuse, 6–10 in. long: peduncle 1 ft. or more long: calyx crimson-magenta; dorsal lobe with a small, triangular base, prolonged into a long tail; lateral lobes oblong-ovate, scarcely prolonged; petals white, longer than the column. May. Colombia. B. M. 5990. I.H. 17:42. F.M. 1872:28.—Var. **conchiflòra**, Veitch. Fls. large; lateral lobes of labellum rotund, concave. Var. **Harryàna**, (*M. Harryàna*, Reichb. f.). Lateral lobes of calyx oval, falcate, the tips usually crossing or turned toward each other. May. F.S.

21:2250. Var. **Armeniaca,** Hort. Fls. apricot-yellow, veined with red; throat of the tube yellow. Colombia. Var. **atrosanguinea,** Hort. Fls. large, with the lateral sepals crimson spotted with magenta, points falcate, turned toward each other. Colombia. Var. **cœrulèscens,** Hort. Lateral sepals broadly semi-ovate, apiculate, crimson-magenta spotted with bluish purple. Colombia. Var. **Gràvesiæ,** Hort. Fls. white. Var. **grandiflòra.** Fls. large, rose-purple. Columbia. Var. **Dénisoni,** Hort. Bull's Blood. Fls. crimson-purple.

SECTION II.

A. *Habit of scape drooping or deflexed.*
  B. *Scape about as long as the lvs.* 8. **platyglossa**
  BB. *Scape shorter than the lvs*.... 9. **leontoglossa**
AA. *Habit of scapes erect or suberect.*
  B. *Scape shorter than the lvs.*
    C. *Lvs. linear to linear-oblong*. 10. **coriacea**
      11. **civilis**
      12. **Peristeria**
    CC. *Lvs. oblong to lance-oblong*.. 13. **corniculata**
      14. **macrura**
      15. **ionocharis**
      16. **nidifica**
      17. **calura**
  BB. *Scape longer than the lvs.*
    C. *Fls. rather small, with a broad, basin-like tube: plants dwarf* .... 18. **Shuttleworthii**
      19. **Estradæ**
      20. **xanthina**
      21. **triangularis**
      22. **hieroglyphica**
      23. **Wageneriana**
    CC. *Fls. larger, with a broad, deep, gibbous tube* .... 24. **elephanticeps**

8. **platyglóssa,** Reichb. f. Densely tufted: lvs. spatulate-lanceolate, narrowed into petioles, 3–4 in. long, as long as or longer than the drooping bracted 1–2-fld. peduncles: fl. small (1 in. long), pale yellow, nearly globular, the lobes pointed but not tailed, the dorsal one upcurved: ovary red; petals linear, as long as the column. Colombia (?) B.M. 7185.

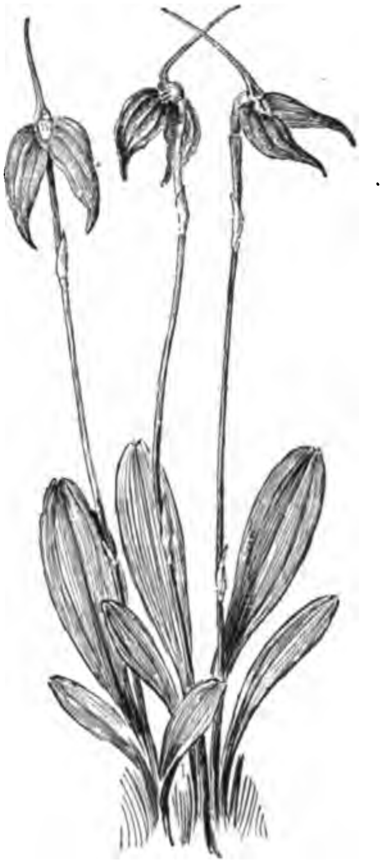
9. **leontoglóssa,** Reichb. f. Tufted: lvs. oblanceolate, short-petioled, spotted beneath with red: peduncle deflexed, mostly shorter than the odd fls.: calyx narrow, the lobes gradually narrowed into fleshy tails or long points, semi-transparent, all of them greenish yellow outside and more or less hairy, crimson-spotted within, the dorsal lobe not greatly unlike the others but often somewhat ascending; petals white with crimson lines. Colombia. B.M. 7245.—The specific name ("lion-tongued") refers to the bearded lip.

10. **coriàcea,** Lindl. Lvs. linear-lanceolate, usually somewhat surpassing the erect, 1-fld., spotted peduncles, which are about 6 in. high: fls. fleshy, the calyx-lobes nearly equal and wide-spreading, triangular at base but gradually narrowed into long points or short tails; lobes greenish yellow and dotted crimson inside; petals white and crimson. Colombia. G.C. III. 21:95.—Lvs. 6–8 in. long, with purplish dotted petioles.

11. **civilis,** Reichb. f. (*M. rufo-lutea*, Lindl.). Lvs. fleshy, linear, keeled, 5–6 in. long: peduncle less than 2 in. long, erect or nearly so: fl. solitary, rather large for the size of the plant, the deep calyx-tube purple at the base and yellow at the top, the long-pointed, flattened lobes yellow: petals small, white, the labellum dotted purple. Peru. B.M. 5476.

12. **Peristèria,** Reichb. f. Tufted: lvs. oblanceolate, sometimes retuse at the apex, 4–6 in. long, twice longer than the rather stout, erect, 1-fld. peduncles: fls. with 3 long, wide-spreading tails, which span 4–5 in., the tube somewhat gibbous beneath; back of the fl. greenish yellow; tails honey-yellow; throat and base of lobes spotted with crimson; petals linear-oblong, white. Colombia. B.M. 6159. F.S. 22:2346.—Named from its resemblance to the dove orchid, Peristeria.

13. **corniculàta,** Reichb. f. Stems short and tufted: lvs. spatulate, very short-pointed, mostly exceeding the 1-fld. peduncles: fls. with yellow, inflated calyx-tube, which is spotted with brown and ribbed, bearing long, very slender brown tails; petals yellow. Colombia. Var. **inflàta,** Veitch. Paler in color, and with smaller spots; lobes broader and golden yellow. Colombia. B.M. 7476.



1374. Masdevallia coccinea (×⅓).

14. **macrùra,** Reichb. f. Stems short and tufted, each bearing a solitary lf. and fl.: lvs. broadly spatulate or broad-oblanceolate, very obtuse or even retuse: peduncles 8–10 in. high, erect: fls. with 3 long tails, which span 8 in. from top to bottom; calyx-tube red-purple on the outside; lobes triangular-ovate in the basal portion, dull red and purple-spotted within, the cylindrical tails yellow, the lateral ones 7-ribbed; petals yellow, spotted brown. Colombia. B.M. 7164.

15. **ionócharis,** Reichb. f. Lvs. ovate-lanceolate, exceeding the erect peduncle: fl. whitish, purple-spotted at base, the lobes triangular-ovate, with yellow tails; petals cream-white. Peru.

16. **nidífica,** Reichb. f. Lvs. oval or oblong, about the length of or longer than the peduncle: fl. white, veined and dotted with crimson passing into yellow on the lobes, the lobes hairy and with long, slender tails, which are yellow in the lateral lobes and crimson in the dorsal lobe; petals white, with crimson lines. Ecuador.

17. **calùra,** Reichb. f. Lvs. mostly shorter than the peduncles, oblong-lanceolate: fl. glossy crimson, with slender, flat tails; dorsal lobe somewhat triangular at base, the lateral ones round-ovate; petals crimson, with white on tip and margins. Aug. Costa Rica.—A free-flowering species.

18. **Shúttleworthii,** Reichb. f. A small species, with lvs. only 2 in. long, on distinct petioles of equal length:

peduncles several, 1-fld., sometimes overtopping the lvs.: fls. large (1 in. across and the tails 2–3 times as long), mauve, dotted with crimson; tails all yellow in the upper half, very slender, the upper one sometimes bent or hooked at the top; petals white. Colombia. B.M. 6372. I.H. 28:435. Var. **xanthocòrys,** Reichb. f., has smaller fls. of pale yellow, dotted with brown or rose.

19. **Estràdæ,** Reichb. f. Very densely tufted: lvs. and petioles 3 in. long, the blade broad, spoon-shaped, and often retuse at the apex: peduncle usually somewhat exceeding the lvs., erect, 1-fld.: flower of marked colors—the upper concave lobe yellow at base and violet-purple above, the lateral lobes violet-purple at base and white or straw-colored above; tails filiform, yellow; petals white, very small. Colombia. B.M. 6171.

20. **xanthìna,** Reichb. f. Like the last, except that the flower is yellow, with a purplish spot on the lateral lobes. Var. **pállida,** Hort., has fls. almost white. Colombia.

21. **triangulàris,** Lindl. Lvs. oblanceolate: peduncle erect, about 4 in. tall: fls. yellow, marked or spotted with purple, the tails dark crimson; lobes similar, triangular-ovate; petals white, the lip spotted with pink or purple and hairy. Venezuela.

22. **hieroglýphica,** Reichb. f. Lvs. oval or oblong: peduncle short (about 3 in. long): flower with tube yellowish at bottom, becoming whitish, marked with crimson; lobes triangular-ovate, all with long tails, the tail of the dorsal lobe hanging forward and marked with purple at its base; petals yellow. June. Colombia.

23. **Wageneriàna,** Linden. Very small, neat and attractive, tufted, 2–3 in. high: lvs. spoon-shaped: peduncles equaling or exceeding the lvs., nearly erect: fls. yellow and crimson-dotted, with slender yellow tails, the upper one inclined backwards; lobes broad, cordate or ovate; petals yellow, odd in shape, the lip rhomboid and toothed. Venezuela. B.M. 4921.

24. **elephánticeps,** Reichb. f. An odd species: lvs. broad-spatulate, obtuse: peduncles 1 ft. long, erect: flower single, party-colored—the dorsal or upper lobe light yellow, the lateral ones ribbed and crimson; calyx-tube gibbous at the base below, all of them gradually produced into stout yellow tails (one of them often crimson), arranged so as to suggest the tusks and raised trunk of an elephant (whence the specific name). Colombia. F. S. 10:997. Var. **pachysépala,** Reichb. f. (*M. Mooreàna*, Reichb. f.), has the dorsal lobe 3-nerved with crimson and the tube spotted.

SECTION III.

A. *Lvs. covered with round papillæ: scape hairy* ....25. **muscosa**
AA. *Lvs. smooth.*
  B. *Fls. small, in many-fld. racemes, angles of the ovary crenulate or the petals toothed* ....26. **abbreviata**
  27. **polysticta**
  28. **melanopus**
  29. **caloptera**
  30. **pachyura**
  BB. *Fls. larger, often expanding in succession: raceme several-fld.: angles of the ovary and petals entire.*
    C. *Color of fls. white* ....31. **Tovarensis**
    CC. *Color of fls. yellow, dotted and shaded with brown or red.*
      D. *Lateral sepals united, forming a boat-shaped cup* ....32. **Ephippium**
      DD. *Lateral sepals nearly plane, at least not strongly cucullate.*
        E. *Tails of the lateral sepals very short or none*...........33. **racemosa**
        EE. *Tails of the lateral sepals long.*
          F. *Lvs. broad, obovate-elliptic* ....34. **Schlimii**
          FF. *Lvs. oblong-lanceolate or oblanceolate.*
            G. *Calyx-tube funnel-shaped, narrowed at the base*.....35. **Reichenbachiana**
            GG. *Calyx-tube broader or gibbous at the base*.........36. **maculata**
            37. **infracta**

25. **muscòsa,** Reichb. f. Lvs. oval-oblong, papillose: peduncle hairy, 3 times exceeding the lvs., with 1 or more yellow fls.: lobes triangular, with reflexed tails; petals narrow and yellow with a brown line in the center, the lip bearing a raised yellow disk and moving upward with a jerk when this disk is touched. St. Domingo.—Fls. ½ in. across.

26. **abbreviàta,** Reichb. f. Lvs. oblong-lanceolate: peduncle many-fld., about 6 in. long: fl. white and freely dotted with red, the tails all deep yellow, the lobes serrate on the edges; petals white, longer than the column, serrate. Peru.

27. **polysticta,** Reichb. f. Densely tufted: lvs. narrow-spatulate, obtuse and often retuse: peduncle exceeding the lvs., about 8 or 9 in. tall and many-fld.: fls. pale lilac, spotted with purple, the margins of the sepals ciliate but not serrate, the tails very slender and spreading (fl. 2–2½ in. across) and yellowish; petals spatulate and serrate. Peru. B.M. 6368. I.H. 22:199. R.H. 1880:250.

28. **melanòpus,** Reichb. f. Much like *M. polysticta:* fls. smaller, white specked with purple, the dorsal sepal keeled, the lobes not ciliate or serrate on the edges and very suddenly contracted into slender yellowish or dark-colored tails; petals linear-oblong, toothed below the apex. Peru. B.M. 6258 (as *M. polysticta*).

29. **calóptera,** Reichb. f. Lvs. oblong-ovate: peduncle short (5 or 6 in.), many-fld.: fl. white with crimson streaks, the tails all slender and orange; dorsal lobe keeled and somewhat hooded; the lateral ones ovate-oblong; petals white, crimson-keeled, serrate. Peru.

30. **pachyùra,** Reichb. f. Lvs. oval-oblong: peduncle erect, slender: calyx with triangular, short-tailed lobes, yellow, with transverse bars and spots of reddish crimson; dorsal sepal triangular, with a thick tail equaling the sepal in length; petals pale yellow. Ecuador. G.C. III. 22:255.

31. **Tovarénsis,** Reichb. f. Lvs. rather small, oblong-spatulate: peduncle 5 or 6 in. long, sometimes exceeding the lvs., 2-edged, several-fld.: fls. clear white and fragrant, the tails yellowish at the ends; dorsal lobe 1½ in. long, very narrow and produced into a reflexed tail; lateral lobes oval, gradually produced into tails shorter than that of the dorsal lobe; petals white. Dec., Jan. Colombia. B.M. 5505. I.H. 26:363. Gn. 48:384. G.C. 1865:914; 1871:1421.—One of the best of the genus.

32. **Ephippium,** Reichb. f. (*M. trochilus*, Linden & And.). Lvs. broad, oblong, 5–7 in. long: peduncle erect, about a foot long, sharply 3–4-angled, stout: calyx with the dorsal lobe cucullate, yellow, dotted with brown, ½ in. in diam.; lateral lobes united, forming a deep boat-shaped, chestnut-brown cup, with several ridges which are greenish outside; all the lobes pass into yellowish tails about 4 in. long; petals white. Colombia. B.M. 6208. I.H. 21:180.—According to Index Kewensis, *M. trochilus* and *M. Ephippium* are distinct species. The former is described as having terete stems.

33. **racemòsa,** Lindl. (*M. Cróssii*, Hort.). Stems creeping: lvs. oblong-ovate, much shorter than the several-fld. racemose peduncles: fls. membranaceous, orange with red lines, erect, 1 in. across, tails very short or none; lateral lobes ovate, blunt-pointed, curving outward so as to form a 2-lobed limb, the dorsal lobe ½ in. long and pointed. Peru.—Not a popular species. Requires a coolhouse.

34. **Schlimii**, Linden. Tufted: lvs. elliptic-obovate, petioled, a ft. or less long, half shorter than the several-flowered peduncles: fls. dull yellow, mottled with bright brown, the tails yellow, about 1¼ in. across without the tails; tails 2–3 times longer than the body of the calyx-lobes, very slender; petals pale yellow, linear-oblong, equaling the column. Venezuela. B.M. 6740. G.C. II. 19:532.

35. **Reichenbachiàna**, Endres. Densely cespitose: lvs. oblanceolate, shorter than the several-fld. peduncles: flower dark red on the outside, yellowish, with red veins on the inside, all the lobes with turned-back tails, the lobes triangular. Costa Rica.

36. **maculàta**, Klotzsch & Karst. Lvs. narrow-oblanceolate, nearly or quite equaling the erect several-fld. peduncle (which is 8–10 in. tall): fls. yellow-tubed, suffused or dotted with red, all the lobes produced into orange-yellow or greenish tails 2 in. long; lateral lobes crimson, with yellow on the margin, the tails drooping; petals yellowish. Venezuela. F.S. 21:2150.

37. **infrácta**, Lindl. Cespitose: lvs. oblong-lanceolate to narrow-lanceolate: peduncle about 6 in. long, several-fld.: calyx pink-purple; dorsal sepals cucullate, lateral sepals entirely united, forming a wide, gaping tube, with cucullate sides and apex, passing into slender, yellowish tails; petals whitish, dotted with pink-purple. Brazil. F.S. 23:2389.

SECTION IV.

38. **Chimæra**, Reichb. f. Fig. 1375. Tufted: lvs. oblanceolate-obtuse, 1 ft. long and 1⅓ in. wide: peduncle wiry, erect, lateral or pendent, several-fld., mostly shorter than the lvs.: fls. opening in succession; calyx-lobes ovate, yellowish, much spotted with deep crimson-purple, tapering into slender tails from 3–11 in. long, purple-brown; petals white, marked with crimson; labellum saccate, white, yellow or pinkish, very variable. Colombia. R. H. 1881:130. G. C. II. 3:41.—One of the most fantastic of orchids, and the type of a most interesting group.

Var. **Rœzlii**, Hort. (*M. Rœzlii*, Reichb. f.). No long hairs on the calyx-lobes, the lobes very dark-colored, with short warts; labellum pink, not yellow. Color the darkest of the section. Often regarded as a good species. Sub-var. **rùbra.** Spots on calyx lobe brown-crimson.

Var. **Wállisii**, Hort. (*M. Wállisii*, Reichb. f.). Calyx-lobes with hispid pubescence, yellowish, spotted with brown-purple; labellum white, yellow within.

Var. **Winniàna**, Hort. (*M. Winniàna*, Reichb. f.). Calyx-lobes elongated, densely black-spotted. In part distinguished from var. *Rœzlii* by its longer tails.

Var. **Backhousiàna**, Hort. (*M. Backhousiàna*, Reichb. f.). Lvs. narrower than in the type: fls. large; calyx-lobes more round, paler, not so thickly spotted; tails short; labellum nearly white. Perhaps a distinct species.

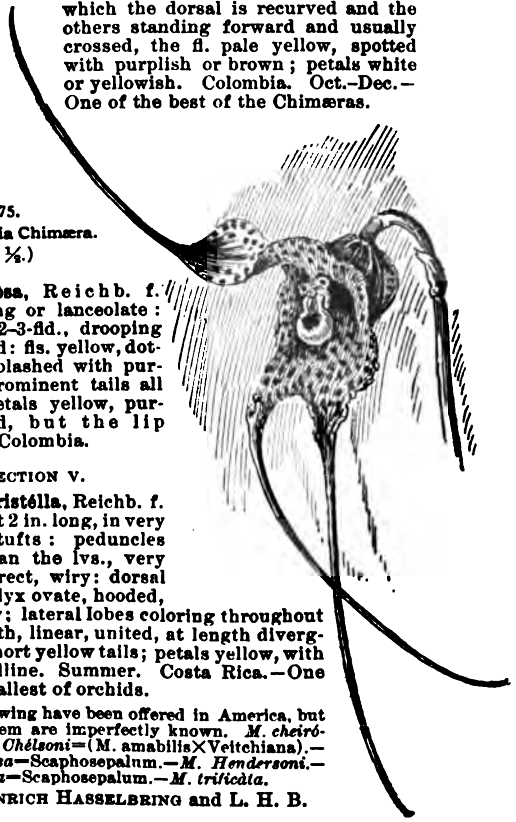
39. **Houtteàna**, Reichb. f. (*M. psittacìna*, Reichb. f.). Densely cespitose: lvs. linear to lance-linear, much exceeding the drooping or deflexed 1-fld. peduncles (which are 4–5 in. long): fls. creamy yellow, spotted with crimson, the long hanging tails brownish red; calyx-lobes semi-ovate to triangular, somewhat hairy (as are also the tips of the tails); petals white or pinkish. Colombia. F.S. 20:2106.

40. **Cárderi**, Reichb. f. Cespitose, with strong ascending foliage and hanging spotted 1-fld. peduncles: lvs. oblanceolate, 3–5 in. long: peduncles green-bracted, 3 in. long: fls. bell-shape, ¾ in. across exclusive of the tails, white, with purple and yellow bars at the base; tails very slender and spreading, 1 in. long, yellow; petals small, white, linear-oblong and obtuse. Colombia. B.M. 7125.—A graceful and pretty species.

41. **Chéstertoni**, Reichb. f. Tufted: lvs. oblong or oblong-spatulate, 5 in. long and nearly or quite 1 in. wide, somewhat longer than the pendent, much-bracted, 1-fld. peduncles: fl. 2⅓ in. across, greenish yellow, spotted and streaked with purple, and bearing 3 spreading, greenish, more or less hooked, flattened tails 1 in. long; petals yellow, very small. Colombia. B.M. 6977.—Odd and distinct.

42. **nycterìna**, Reichb. f. Often confused with *M. Chimæra*, but a smaller and less showy plant: tufted: lvs. oblanceolate, somewhat fleshy, channelled, 6 in. long, not narrowed into a petiole: peduncle 1-fld., 3 in. long, drooping: fl. triangular, 2 x 3 in., with tails 3 in. long, hairy inside, brown-yellow and purple-spotted; petals yellow, with red spots, pouch-like, serrate. Colombia. I.H. 20:117–18 (as *M. Chimæra*).—Odd.

43. **bélla**, Reichb. f. Lvs. oblong-lanceolate, channelled, about 8 or 9 in. long, narrowing to the base: peduncle 1-fld., drooping or horizontal, ½ ft. long, slender: fls. large and spider-like, triangular in outline, 3 in. across, with stiffish tails 4 in. long, of which the dorsal is recurved and the others standing forward and usually crossed, the fl. pale yellow, spotted with purplish or brown; petals white or yellowish. Colombia. Oct.–Dec.—One of the best of the Chimæras.



1375. Masdevallia Chimæra. (×½.)

44. **radiòsa**, Reichb. f. Lvs. oblong or lanceolate: peduncle 2–3-fld., drooping or deflexed: fls. yellow, dotted and splashed with purple, the prominent tails all purple; petals yellow, purple-spotted, but the lip whitish. Colombia.

SECTION V.

45. **triaristélla**, Reichb. f. Lvs. about 2 in. long, in very crowded tufts: peduncles longer than the lvs., very slender, erect, wiry: dorsal lobe of calyx ovate, hooded, tail yellow; lateral lobes coloring throughout their length, linear, united, at length diverging into short yellow tails; petals yellow, with a red midline. Summer. Costa Rica.—One of the smallest of orchids.

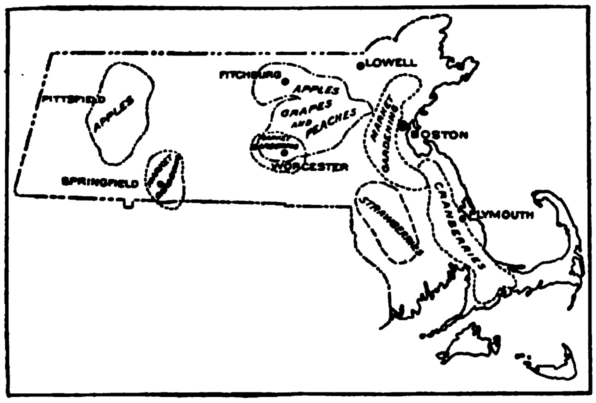
The following have been offered in America, but most of them are imperfectly known. *M. cheiróphora.*—*M. Ohélsoni*=(M. amabilis×Veitchiana).—*M. gibberòsa*=Scaphosepalnm.—*M. Hendersoni.*—*M. punctàta*=Scaphosepalum.—*M. triticàta.*

HEINRICH HASSELBRING and L. H. B.

MASSACHUSETTS HORTICULTURE. Fig. 1376. The horticultural interests of Massachusetts are fully equal to those of agriculture proper, when we consider the production of fruits, vegetables, flowers, and the labor and expense applied to the growth of ornamental trees, shrubs and plants and their use in decorating the homes of her people, among whom there are probably more comfortable, well-kept and beautiful homes than can be found in any similar area in the world. The people of this state probably consume more of the luxuries of life than any other people on the same area, and among the so-called luxuries may be classed fruits, fancy vegetables and flowers.

The soil of Massachusetts is generally considered unproductive and poorly adapted to horticultural pursuits, and this is true in so far as it refers to large areas of exceptionally fertile land, of which that in the Connecticut valley is the only section of more than a few acres in extent. Everywhere about the state, however, there are small areas of land suited to the growth of almost every crop succeeding in similar latitudes. By business enterprise, persistent effort and skill, profitable horticultural crops can be grown. The local products largely supply the markets in their season. Apples are also exported.

The amount of fruit produced within the limits of the state is not nearly up to the home consumption, except cranberries and possibly the apple in some seasons. Even



1376. Massachusetts.
Showing some of the leading horticultural areas.

in seasons of an unusual crop in the state, large quantities of apples from other states are shipped into our markets, because in many cases they are of superior size and beauty. Pears are shipped into our markets from the southern states and California, and as the market for this fruit is limited, prices often rule very low. Eastern Massachusetts is admirably adapted to pear-growing.

Peach trees can be grown up to about ten to fifteen years of age when given the proper attention, but the fruit buds are frequently killed in the winter, and not more than one crop may be produced in three years. However, even under these conditions, when the trees are planted on rather light land and well cared for, one crop in three years is often more profitable than most other fruit or vegetable crops. The fruit on trees properly cared for is large, of the finest color and quality, and the fresh, ripe condition in which the grower can put it into the local markets makes it quickly salable at the highest prices.

Plums are not grown to a great extent, the larger markets being supplied chiefly by New York and California. Few orchards remain productive longer than ten or twelve years, on account of the black-knot, leaf-blight and brown-rot. Within the past four or five years Japanese plums have been largely planted, but have borne little fruit up to this time, so that their status in the market is not fully established.

The cherry, owing to the attack of the black aphis, the plum curculio and brown-rot, is very little grown as an orchard fruit. A few vigorous and productive trees may be seen here and there by the roadside, about old homesteads or on the lawn, where they live longer and attain greater size than when grown under a high state of cultivation in the garden or orchard, because of the fact that when grown too rapidly the trunks crack on the south side and the trees soon die. Our markets are largely supplied with cherries from California, New York and other states.

Small fruits are more grown and more nearly supply local markets than do the large fruits. The supply of very early fruit comes from the southern states of the country, but home-grown fruit is so much superior in quality that it sells at reasonable prices, notwithstanding prices may have been very much reduced by an oversupply of the southern product. Of the smaller fruits, grapes are profitable mostly when grown on rather light land and at high elevations with a southern exposure. The chief obstacles to success are early frosts in the fall and late frosts in the spring. Currants are grown to a considerable extent, almost every garden containing more or less currant bushes for home supply, while many large plantations may be found near every large town or city. The conditions of success are a rather moist, rich soil, with the bushes trained into a very compact form and pruned so that the fruit will be borne on wood that is not over three or four years old. Gooseberries are little grown, although the demand is rather on the increase. The more hardy kinds can be as easily grown as the currant, while the European sorts and their hybrids, many of them, require much care and skill. Like the currant, the blackberry is largely grown for home use, and also for market. It succeeds upon a great variety of soils, can be grown cheaply and sells at good prices. Few plantations will be profitable on the same land more than from five to seven years unless the soil is strong and rich. It is the practice of most growers to plant a new lot every six or seven years. The red raspberry is the most popular of the bush fruits, and when successfully grown is the most profitable. For success it requires a deep sandy loam, retentive of moisture, but plantations must be renewed after six or eight years' growth on one piece of land. The blackcap raspberry has found less and less of favor each year with our people, and can only be sold at very low prices in our city markets.

The business of market-gardening has made rapid strides in the state in the past ten years, and the demand for choice vegetables continues more or less the year round. Even in the matter of competition with vegetables from the South during the winter, our local growers have reached a good degree of success. In almost every part of the state may be found forcing-houses for the growth of lettuce, tomatoes, cucumbers, rhubarb, asparagus, etc., and notwithstanding the cost of such structures and the fuel to keep up the necessary heat, the increase in the number of forcing-houses within the past two years is a certain indication that the business is profitable.

It is perhaps in the growth of cut-flowers and house and decorative plants that this state excels in horticulture. As a rule, the largest establishments of this kind are located near the large cities, though in some cases they may be found in some of the more rural towns. The horticulturists of Massachusetts do not understand their advantages in having the best markets in the world at their doors, and a great variety of soils suitable for the growth of many of the varied crops. By persistent effort and superior skill they could supply these markets largely, and thus retain within the state much of the wealth that now goes outside to pay for the produce that could be raised at home. S. T. Maynard.

In commercial horticulture, Massachusetts is not the equal of some other states, although its market-gardening and floricultural interests are large, but its influence on the horticulture of the country is more important than acres and tonnage. The best horticulture is that which develops under difficulties, because it develops the man. The love of the country and attachment to its own soil are strong in Massachusetts. Individuality has full course. It is a land of home-loving people. It has developed the amateur horticulturist to perfection,—the person who grows the plant and dresses the soil for the very love of it. There are many large collections of choice plants, and great numbers of artistic, compact and tidy garden-homes. There is keen appreciation of the merit of well-grown things. The influence of the Massachusetts Horticultural Society has been incalculable. Since 1829 it has had its stated discussions, held its periodical shows, collected its library and records. It is a center of education and culture. The establishment of Mt. Auburn cemetery in 1831 was the beginning of the movement in this country for cemeteries in the open as distinguished from the churchyard. L. H. B.

MASSÁNGEA comprises one species (*M. musaica*, Morr.), which is now referred to Guzmania, *G. musaica*, Mez. It is not known to be in the Amer. trade, although it is cult. in the Old World. It is from Colombia. It is stemless, with 20 or less broad-strap-shaped, entire-edged lvs., which are marked transversely with purple, and a head of small fls. (corolla shorter than calyx) which are covered by very showy red bracts. B.M. 6675. I.H. 24:268.—Known also as a Tillandsia, Billbergia, Caraguata and Vriesea.

MAST. English name for beechnuts; American for any woods-nuts eaten by swine.

MATRICÀRIA (*mater*, mother, from its use in diseases). *Compósitæ.* From Chrysanthemum it differs mostly in the akenes, which are 3–5-ribbed on the interior face and ribless on the back; also in having a higher or more conical receptacle, and bracts in few rather than many series. Matricarias are annual or perennial weedy herbs, often heavily scented, about 25 species in many parts of the world. The foliage is much cut or divided into thread-like divisions.

The Matricarias are border plants in cultivation, and others are introduced weeds. They are commonly confounded with species of Chrysanthemum and feverfew. The *M. eximia plena* of the trade is a form of *Chrysanthemum Parthenium* (var. *tubulosum*). It is a good hardy annual, with white, double heads, growing 2 ft. tall. Matricarias demand the care given to annual Chrysanthemums. The two following are annuals or biennials.

inodòra, Linn. (*Chrysánthemum inodòrum*, Linn. *Pyrèthrum inodòrum*, Smith). Nearly or quite glabrous, branchy diffuse annual, 1–2 ft. tall, from Europe and Asia. Lvs. many, sessile, 2–3-pinnately divided or dissected: heads 1½ in. across, terminating the branches, with many acute white rays: akenes inversely pyramidal, with 3 conspicuous ribs. Not uncommon in fields eastward. Var. **plenissima**, Hort. (var. *ligulòsa*, var. *múltiplex*, *M. grandiflòra*, Hort. not Fenzl.), is a common garden plant with very double, clear white, large heads. It is floriferous, and the fls. are fine for cutting. G.C. II. 12:753.—It often persists and blooms the second year. Foliage little or not at all scented.

parthenoides, Desf. (*M. Capénsis*, Hort., not Linn. *Anthemis parthenoides*, Bernh. *Chrysánthemum parthenoides*, Voss). Annual, or biennial under cultivation, 2 ft. or less high, soft-hairy when young, but becoming smooth, bushy in growth: lvs. petiolate, twice divided, the ultimate segments ovate and often 3-lobed: fl.-heads loosely corymbose, in the garden forms usually double, white.—A handsome plant, probably of Old World origin, useful for pots, and blooming till frost.

Other introduced species from Eu. are *M. Chamomilla*, Linn., a glabrous, much-branched annual, with finely dissected lvs., 10–20 truncate white rays, and an oblong, nearly terete akene with 3–5 faint ribs; and *M. discoidea*, DC. (M. matricarioides, Porter), a very leafy and glabrous annual with no rays and a lightly nerved oblong akene. L. H. B.

MATRIMONY VINE. See *Lycium*.

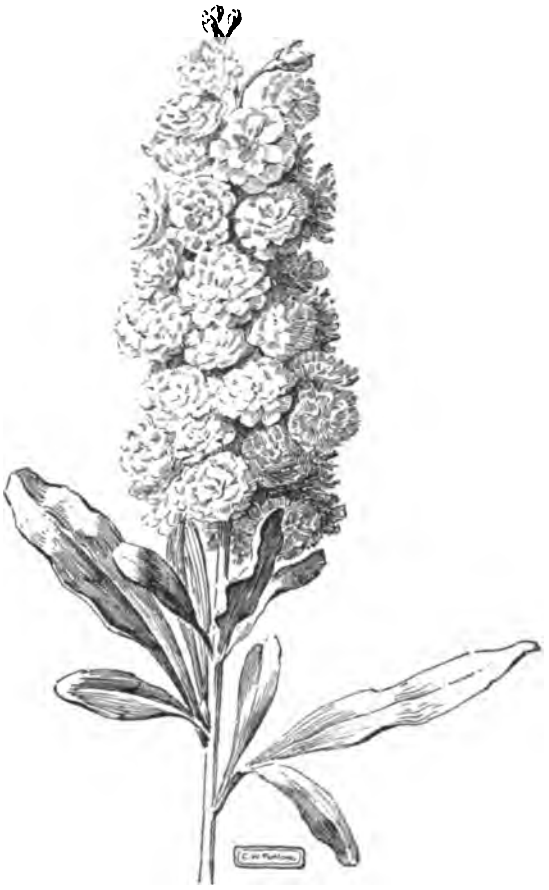
MATSÈA. Consult *Manettia*.

MATTEÙCCIA (from C. Matteucci, an Italian physicist). *Polypodiàceæ*. A small genus of north temperate ferns, with leaves of two sorts, the sterile growing in crowns from erect rootstocks, and the fertile growing from the interior of the crown. Our species is known as the Ostrich Fern and is one of the most easily cultivated, as well as one of the handsomest of our native species. It multiplies rapidly by offsets sent out from the rootstock. Commonly known as an Onoclea or Struthiopteris.

Struthiópteris, Todaro (*Struthiópteris Germánica*, Willd. *Onoclèa Struthiópteris*, Hoffm.). Ostrich Fern. Lvs. (sterile) 2–6 ft. long, with the lowest pinnæ gradually reduced; fertile lvs. 10–15 in. long, pinnate, with the margins of the pinnæ closely inrolled and covering the sori. Eu. and northeastern N. Amer.—Wildenow regarded the American species distinct, but by most botanists it is considered as identical with the European species. L. M. Underwood.

MATTHÌOLA (Peter Andrew Matthioli, 1500–1577, Italian physician and writer on plants). Sometimes spelled *Mathiola*. *Cruciferæ*. Stock. Gilliflower, when used at the present day, means Matthiola or sometimes Cheiranthus; formerly it designated *Dianthus Caryophyllus*. From Cheiranthus, the wallflower, this genus differs in its winged seeds, which are as broad as the partition, the stigma lobes erect or connivent and often thickened on the outside, the silique not 4-sided (terete or compressed). Of Matthiolas there are probably 30 species, widely distributed in the Old World and Australia. They are herbs or subshrubs, tomentose, with oblong or linear-entire or sinuate lvs., and large, mostly purple fls. in terminal racemes or spikes.

The true Stocks (Fig. 1377) are of this genus. The Virginian Stocks are diffuse small-flowered annuals of the genus Malcomia (which see). Stocks are of two general types,—the autumn-blooming, Queen or Brompton Stocks, and the summer-blooming, Ten Weeks or Intermediate Stocks. By some persons these classes are made to represent two species—*M. incana* and *M. annua* respectively. It is probable, however, that they are garden forms of one polymorphous type. Even if distinct originally, it is not possible now to distinguish them by definite botanical characters. Stocks are amongst the most common of all garden flowers. The two types cover the entire blooming season, particularly if the earlier ones are started indoors. Most of the garden forms are double, although some of the single types are desirable for the definiteness and simplicity of their outlines. The colors are most various, running from white through rose, crimson, purple and particolored. The fls. are fragrant. For culture, see *Stock*.



1377. Ten Weeks' Stock—Matthiola incana, var. annua (× ½).

incàna, R. Br. Common Autumnal or Brompton Stock. Biennial or perennial, becoming woody at base, but usually treated as an annual: erect-branching, closely tomentose-pubescent, the stems stiff and cylindrical: lvs. alternate, tapering into a petiole, long-oblong or oblanceolate, entire, obtuse: fls. with saccate lateral sepals and large petals with long claws and wide-spreading limb, borne on elongating stalks in an open, terminal, erect raceme: siliques becoming 3–4 in. long, erect. Mediterranean region; also Isle of Wight. —*M. glabrata*, DC., is a glabrous form.

Var. **ánnua**, Voss (*M. ánnua*, Sweet). Ten-Weeks, or Intermediate Stocks. Fig. 1377. Annual, less woody, blooming earlier.—A shining-lvd. variety is known.

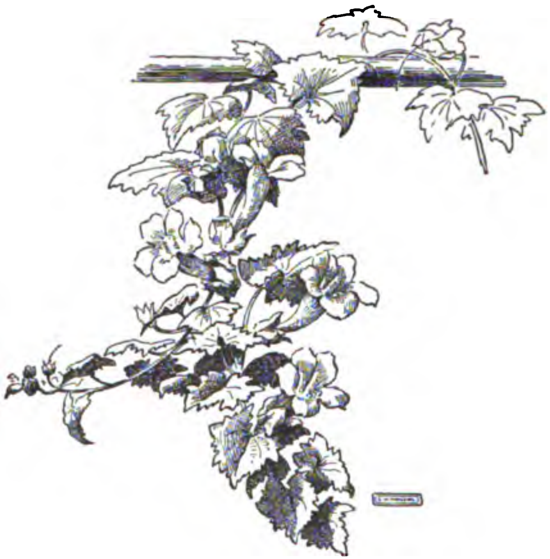
bicórnis, DC. Half-shrubby, straggling annual or biennial: fls. smaller than those of *M. incana*, purplish or lilac, fragrant by night, closing by day: pod terete, long, 2-horned: lvs. pinnatifid, or the uppermost entire. Greece, Asia Minor.

M. sinuàta, var. *Oyénsis*, Rouy & Fouc., is figured in B.M. 7703 (1900), where it is said that "the name Oyensis has been corrupted in gardens to Ohiensis and Chinensis." The plant is from the Ile d' Yeu (Insula Oya, whence the name) on the coast of France. It is an annual or biennial, with sinuate-toothed lvs., hairy, and with large white fragrant fls. Not known to be in cult. in this country.

L. H. B.

MAURÁNDIA (after Maurandy, professor of botany at Cartagena, Spain). Also written *Maurandya*. *Scrophulariàceæ*. About 5 species of Mexican climbers, with usually halberd-shaped lvs. and showy, irregular trumpet-shaped fls., white, rose, purple and blue, the throat usually white or light-colored. The fls. are somewhat 2-lipped. The commonest species is *M. Barclaiana*, which is procurable in a greater range of colors than the others. Maurandias are desirable vines for winter-flowering in cool greenhouses, but since they bloom the first year from seed, they are almost wholly grown for summer bloom outdoors and treated like tender annuals. They have a slender habit and grow about 10 ft. in a season. In the fall the vines may be taken up and removed into the house if desired.

Botanically, this genus is nearest to the snapdragon, though the throat of the flower is not closed. The plant known to the trade chiefly as *Maurandia antirrhiniflora* is now referred to Antirrhinum. (See *Antirrhinum*, where this plant is figured.) It is a climber and requires the culture of Maurandia. Maurandias climb by the twisting of the leaf- and flower-stalks. They are glabrous or pubescent: lvs. alternate, or the lower ones opposite, halberd-shaped, angular-lobed or coarsely toothed: calyx 5-parted; segments narrow or broad: corolla tube scarcely bulged at the base; posterior lip 2-cut; anterior lip variously parted: stamens 4-didynamous.



1378. Maurandia scandens (×¼).

A. *Seeds tubercled, wingless: calyx segments narrow: lvs. hastate, not serrate. (Subgenus Eumaurandia.)*

B. *Calyx distinctly glandular-pilose: segments long-attenuate.*

Barclaiàna, Lindl. Usually, but not originally, written *Barclayana*. B.R. 13:1108. L.B.C. 14:1381. V. 5:353. —The following trade names advertised like species-names are presumably all color-varieties of this species: *M. alba, albiflora, Emeryana rosea, purpurea grandiflora, varius*. The last is a trade name for mixed varieties.

BB. *Calyx glabrous, shorter.*

sempérflorens, Ort. Fls. lavender-colored; throat white. B.M. 460.—Cult. in S. Calif.

AA. *Seeds with a lacerated or irregular wing: calyx segments leafy and broad: lvs. triangular-ovate, serrate. (Subgenus Lophospermum.)*

B. *Corolla lobes obtuse or even notched.*

erubéscens, Gray. Lvs. somewhat triangular in outline, serrate: fls. 3 in. long, rosy pink. B.M. 3037, 3038. B.R. 16:1381. G.C. II. 20:501.—Cult. in S. Calif.

BB. *Corolla lobes acute.*

scándens, Gray (*Lophospérmum scándens*, D. Don). Fig. 1378. Perhaps only a botanical variety of the preceding. B.M. 3650.—A hybrid with the preceding is shown in B. 5:242.

W. M.

MAURÍTIA (after Prince Moritz, of Nassau, 1567–1665, patron of Piso and Marcgraf; by his aid a Natural History of Brazil was published). *Palmàceæ*. Very graceful fan palms, almost spineless: stems very slender, obscurely ringed: lvs. pinnately flabelliform, semi-circular, orbicular or wedge-shaped, the lobes lanceolate, acuminate; rachis long or short; petiole cylindrical: ovary perfectly 3-celled. There are 6 or 7 tropical American species.

flexuòsa, Linn. f. MORICHE PALM. Stems without stolons: lvs. 20–30, erect-spreading, 9–16 ft. long; blade 2½–4 ft. long, yellowish beneath; lobes ⅔–1⅓ in. wide: petiole stout, rigid, semi-cylindrical, equaling the blade: fr. nearly 2 in. long, depressed-globose; seed 1⅓ in. long. Trop. Brazil.—Offered in 1889 by Reasoner Bros. In the Amazon delta this palm grows to 150 ft. or more in height, with a trunk often 30 in. in diam. at base. "The fruit is spherical, the size of a small apple, and covered with rather small, smooth, brown, reticulated scales, beneath which is a thin coating of pulp. A spadix loaded with fruit is of immense weight, often more than two men could carry between them.—*Wallace*, "Palms of the Amazon."

JARED G. SMITH.

MAXILLÀRIA (Latin, *maxilla*, jaw; referring to the mentum). *Orchidàceæ*. Mostly pseudobulbous, epiphytic orchids, resembling Lycaste in general appearance. The genus contains over 100 species, dispersed at various altitudes in Mexico, Brazil and the West Indies. About 15 species are offered by dealers in America. Many of these have small flowers and are of value only in collections. They are, however, easily grown, and blossom profusely. Among those given below, the large, white-flowered *M. grandiflora* and *M. venusta*, and the white and purple *M. Sanderiana* are probably the best species. Rhizomes short or long, creeping or erect, and clothed with distichous lvs.: pseudobulbs clustered or scattered on the rhizome, 1–2-lvd. or densely distichophyllous at the apex of the rhizome: lvs. leathery or subfleshy, plicate or plane and keeled, distichous: sepals subequal, free from each other but united with the foot of the column and forming a projecting mentum; petals similar or smaller: labellum 3-lobed, movably articulated to the foot of the column: lateral lobes erect; middle lobe with longitudinal callosities. The scape arises apparently from the base of the pseudobulb, on the very young leafy axis, but lower down than the corresponding new growth. Pollinia 4, seated on a broad, scale-like stipe. The distichous arrangement of the lvs. distinguishes this genus from Lycaste. For *M. Harrisoniæ* and *tetragona*, see *Lycaste*.

HEINRICH HASSELBRING.

Maxillarias are of easy culture, and can be grown under various methods of treatment with fair success. The best compost consists of clean peat fiber taken from the several species of Osmunda, and live sphagnum, both chopped rather fine and well mixed together. After the receptacle is half filled with clean drainage and the plant properly placed, the compost should be pressed firmly in around the roots, interspersing it with nodules of charcoal. In their native habitats, many of the fine-rooted species grow on rocks and trees with very little compost attached. The base of the pseudobulbs or rhizome should rest on a convex surface raised a little above the rim of the pot when finished. Maxillarias delight in a cool, moist, shaded location at all seasons where the winter temperature will not exceed 58° F. by night and not over 60° or 65° by day. During summer they must be grown as cool as possible with ventilation at all seasons when admissible, especially in wet, heavy weather. Water should be given in abundance while the plants are growing and not too sparingly when at rest, as the plants are subject to spot if kept too dry. Weak liquid cow manure is beneficial occasionally during root action.

Maxillaria has two recognized horticultural groups or sections; viz., caulescent and stemless. The caulescent section embraces *M. tenuifolia*, *M. variabilis* and kindred species, having scandent rhizomes and often obscure flowers. These should all be grown under pot culture and afforded supports to climb on, such as small cylinders or rafts of open woodwork with a little compost worked in the openings, or Osmunda rhizomes supported obliquely in the pots to which the plants can attach themselves as they grow upward, and thus be supplied with moisture for the young roots. To the stemless section belong those with clustered pseudobulbs, as *M. fuscata*, *M. grandiflora*, *M. luteo-alba*, *M. picta*, *M. Sanderiana* and *M. venusta*. Some of these have very showy flowers. Nearly all do best under pot-culture. *M. Sanderiana* and others are exceptions, however, and grow best under basket culture, not too much compost and an airy position. Demand for Maxillarias not being great, the market usually relies on new importations, but stock may also be increased by division between the pseudobulbs as the plants start new action.

ROBERT M. GREY.

INDEX.

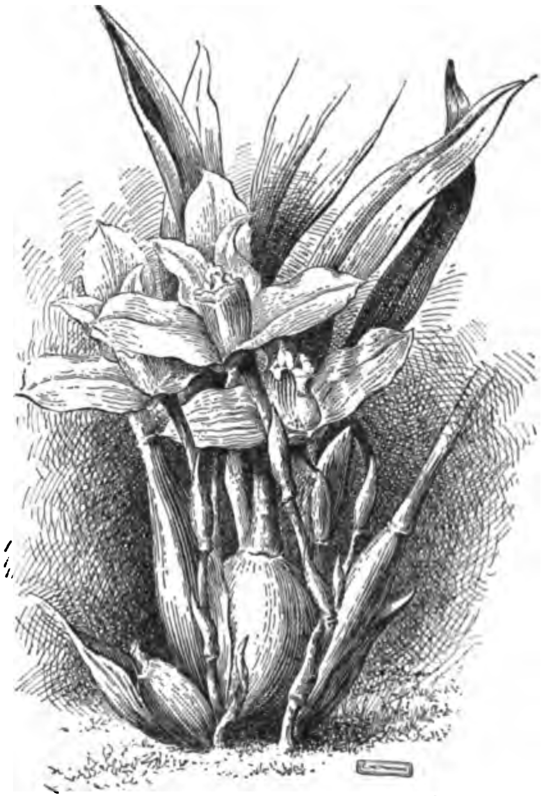
angustifolia, 12.
elegantula, 8.
fuscata, 6, 7.
grandiflora, 2.
Henchmanni, 12.
Houtteana, 11.
Lehmanni, 3.
Lindeniæ, 5.
luteo-alba, 9.
picta, 6.
rufescens, 7.
Sanderiana, 4.
striata, 10.
tenuifolia, 13.
variabilis, 12.
venusta, 1.

A. *Pseudobulbs clustered on the creeping rhizome.*
  B. *Fls. mostly white, large and showy.*
    C. *Sepals long-lanceolate*......... 1. **venusta**
    CC. *Sepals broad, ovate, triangular or oblong.*
      D. *Middle lobe of the labellum tongue-like*............... 2. **grandiflora**
      3. **Lehmanni**
      DD. *Middle lobe of the labellum rounded*.................. 4. **Sanderiana**
      5. **Lindeniæ**
  BB. *Fls. yellow and brown.*
    C. *Sepals and petals nearly alike, oblong*...................... 6. **picta**
    7. **rufescens**
    CC. *Sepals and petals dissimilar, the latter smaller*........... 8. **elegantula**
    9. **luteo-alba**
    10. **striata**
AA. *Pseudobulbs more or less distant, on an ascending rhizome: lvs. grass-like: fls. small and numerous*....11. **Houtteana**
12. **variabilis**
13. **tenuifolia**

1. **venùsta**, Linden & Reichb. f. Pseudobulbs oblong, compressed, 2-lvd.: lvs. oblong-lanceolate, acuminate, plane, 1 ft. long: scapes 6 in. long, bearing a single glistening white fl. 6 in. across: sepals and petals long-lanceolate, acuminate, spreading; the lateral sepals wider, labellum much smaller; middle lobe triangular recurved, obtuse, yellow; lateral lobes very obtuse, bordered with red; disk with a rounded, hairy callus. Winter and spring. Colombia. B.M. 5296. G.C. III. 12:367 (abnormal).—A large-fld., showy species.

2. **grandiflòra**, Lindl. Fig. 1379. Pseudobulbs clustered, oval: lvs erect, plane, keeled, ovate-oblong, 1 ft. long: scapes erect, 3–6 in. long, bearing solitary, large white fls. 3–4 in. across; sepals broadly ovate to oblong; petals ovate acute, suberect, with recurved tips; labellum saccate, white, much-striped with purple on the sides; middle lobe tongue-like, white, bordered with yellow. Aug. Peru and Colombia. I.H. 17:14.—A very showy and beautiful plant.

3. **Léhmanni**, Reichb. f. Fl.-stalks nearly 1 ft. in length, bearing white fls. nearly as large as those of *Lycaste Skinneri:* side lobes of the labellum light ochre outside and light reddish brown with chestnut veins inside; middle lobe triangular, wavy, sulfur color. Ecuador.—Resembles *M. grandiflora*, but distinguished by the character of the lip.



1379. Maxillaria grandiflora (× nearly ½).

4. **Sanderiàna**, Reichb. f. Pseudobulbs orbicular to broadly oblong, 1–1½ in. long: lvs. few, 6–10 in. long, oblanceolate, plane, keeled: scapes 2–3 in. long: fls. 4 in. across, pure white, with the bases of the segments purplish red, broken upwards into blotches; dorsal sepals oblong-obtuse, concave; lateral sepals triangular-ovate, forming a broad mentum at base; lateral lobes of the labellum almost obsolete, middle lobe rounded, crisp, bright yellow, throat dark purple, with a club-shaped callus. Ecuador. B.M. 7518. R.H. 1894:526. J.H. III. 26:495.—The finest known species.

5. **Lindeniæ**, Hort. (*M. Lindeniàna*, Rich & Gal.?). Plants resembling *M. Sanderiana*, but the fls. larger and more open: sepals triangular-lanceolate, spreading, 3 in. long, pure white; petals shorter and wider, erect, white; labellum fleshy, obovate, somewhat crisp, recurved, pale yellow, with 5–6 red lines on the lateral lobes. S.H. 1:219.

6. **picta**, Hook. (*M. fuscàta*, Klotzsch). Pseudobulbs 1½ in. high, ovate, furrowed, bearing 1–2 plane, strap-shaped lvs. 1 ft. long: scape 5–6 in. high: fls. nodding; sepals and petals oblong-linear, acute, incurved, deep orange spotted with purple within, white with deep purple spots outside; labellum oblong, whitish, spotted; side lobes small, rounded; midlobe recurved, apiculate. Winter. Brazil, Colombia. B.M. 3154. B.R. 21:1802.—Handsome.

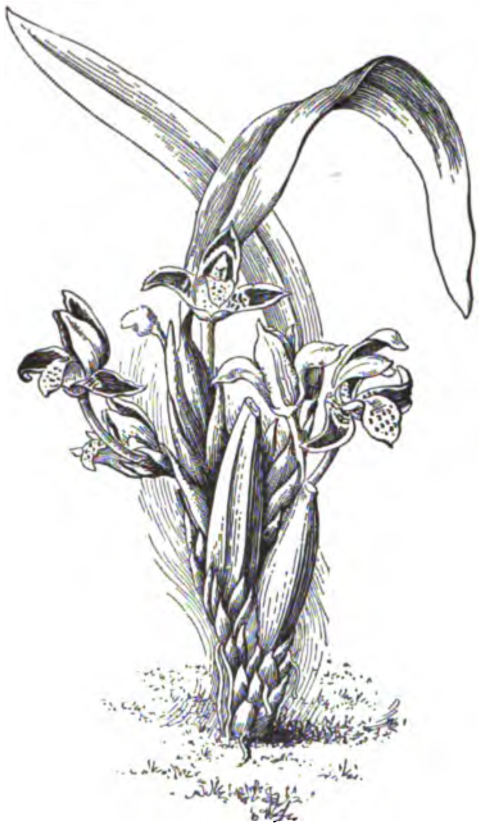
7. **rufèscens**, Lindl. (*M. fuscàta*, Reichb. f.). Pseudobulbs ovate, subtetragonal, 1-lvd.: lvs. lanceolate,

acuminate: scape short, with 1 small fl.: sepals and petals oblong obtuse, yellow-tinged and spotted with reddish orange; side lobes of labellum small, sharp; middle lobe elongate, sub-quadrate, emarginate; all yellow, spotted with crimson. Trinidad. B.R. 22:1848.—Not valuable.

8. **elegántula**, Rolfe. The bases of the segments are white, the outer halves pale yellow, marked with chocolate color. Nov. G.C. III. 22:420.—From the illustration, the sepals are ovate-lanceolate, wavy and recurved, the lower pair broader; petals smaller, pointing forward, concave, wavy, with reflexed tips: lvs. lanceolate-acute.

9. **lùteo-álba**, Lindl. Pseudobulbs long-ovate, 1-lvd., 2½ in. high: lvs. broad, obtuse, narrowed at the base, 1 ft. long: scapes 6 in. long: sepals 3 in. long, ½ in. wide, tawny yellow fading to white at the base, brown on the back, the lower pair drooping; petals erect, pointing forward, one-half as long, white to brown and yellow above; side lobes of the labellum yellow with purple streaks; middle lobe recurved, hairy, yellow, with white margins. Colombia.—A robust species, which soon fills large-sized pans, making very ornamental plants.

10. **striàta**, Rolfe. Scapes 6–8 in. long, bearing solitary fls. 4–5 in. across the sepals: dorsal sepals ovate-oblong; lateral sepals ovate-attenuate, forming a broad mentum at the base, often twisted and recurved; petals narrower, wavy; both sepals and petals are yellow, striped with red-brown; lobes of the labellum crenate-wavy, white with purple veins, the lateral ones recurved. Aug. Peru. G.C. III. 20:631. G.M. 41:705.



1380. Maxillaria Houtteana (× about ⅛).

11. **Houtteàna**, Reichb. f. Fig. 1380. Rhizome erect or ascending, clothed with brown sheaths: pseudobulbs 2–2½ in. long, linear-oblong, compressed: lvs. solitary, 6 in. long, linear, obtuse, keeled: scape 1½–2 in. long: fls. nearly 2 in. across; sepals ovate-lanceolate, dirty yellow outside, red-purple within, with a yellow margin and spotted below; petals smaller, colored like the sepals; labellum without lateral lobes, oblong-obtuse, yellow with red-brown spots, and an ill-defined callus on the base. April. Guatemala and Venezuela. B.M. 7533.—Fls. last about a month in the coolhouse.

12. **variábilis**, Batem. (*M. angustifòlia*, Hook.). Pseudobulbs oval, compressed: lvs. solitary, plane, linear-oblong, obtuse or emarginate: fls. solitary, small, deep purple; sepals linear-oblong, acute, the lateral ones produced at the base; petals subsimilar; labellum oblong, retuse, fleshy, membranous at the base: disk with a small callus. Midwinter. Mex. B.M. 3614 (as *M. Henchmanni*).—A small plant, of interest only to collectors.

13. **tenuifòlia**, Lindl. Rhizomes erect, bearing ovate-compressed pseudobulbs at irregular intervals: lvs. linear-lanceolate, acute, recurved, grass-like, plane: fls. small, spotted and shaded with purple and yellow; sepals ovate-lanceolate, margins revolute, reflexed; petals ovate, acute, erect; labellum oblong, reflexed, with an entire, oblong callus. Spring. Mex. B.R. 25:8.—Not valuable

M. dichròma, Rolfe. Allied to M. venusta, but the petals are suffused on the lower half with light pinkish purple, the lip being margined with the same color; sepals white. Grows freely in a coolhouse, the fls. lasting for a long time.

HEINRICH HASSELBRING.

MAXIMILIÀNA (after Maximilian Joseph, first king of Bavaria, 1756–1825, not Prince Maximilian Alexander Philipp, as said by some). *Palmàceæ*. Tall, pinnate-leaved palms, spineless, with ringed trunks: lvs. with linear pinnæ in groups, the midveins and transverse nerves prominent; rachis bifacial, strongly compressed; petiole plano-convex. This genus is distinguished from Attalea as follows: petals of the male fls. minute, much shorter than the 6 exserted stamens: fr. 1-seeded; pinnæ in groups instead of equidistant. From Cocos and Scheelia it differs in the above floral characters and in the plano-convex instead of concavo-convex petioles. Fr. yellow or brown, ovoid, with fibrous or fleshy pericarp and bony endocarp, the latter 3-pored at the base, acuminate at the apex. Species 3, St. Kitts, Trinidad and S. Am. For culture, see *Palms*.

A. *Pinnæ verticillate.*

Maripa, Drude (*Attalèa Maripa*, Mart.). Stem thick, very tall: lvs. 15 ft. long; segments ensiform acute, divaricate, the lower 3 ft. long, 2 in. wide, gradually diminishing upwards. Brazil.

AA. *Pinnæ in opposite clusters.*

règia, Mart. (*Attalèa amygdalina*). Fig. 1381. Stem 15–20 ft. high, 12–16 in. thick at the base, 3 times as thick above because of the persistent petiole bases: lvs. 15 ft. long; segments more slender, papery, disposed in opposite clusters, the upper as broad as the lower. Brazil. G.C. III. 1:232.

JARED G. SMITH.

MAY in English poetry refers to the flowers of the hawthorn, *Cratægus Oxyacantha*.

MAY APPLE. *Podophyllum*. See also *Passiflora*.

MAYBERRY, JAPANESE GOLDEN. Name proposed by Luther Burbank for *Rubus palmatus*.

MAYFLOWER of English literature is the same as the hawthorn, *Cratægus Oxyacantha*; of New England is *Epigæa repens*; of the more western states, *Hepatica*.

MAY-WEED. *Anthemis Cotula*.

MAYTÈNUS (from a Chilean name). *Celastràceæ*. A genus of about 50 species of trees and shrubs mostly from South America, some from tropical America. Botanically they are near our common bittersweet, *Celastrus scandens*. Aside from habit, Maytenus differs from Celastrus in having the ovary confluent with the disk instead of free, and the cells are mostly 1-ovuled instead of 2-ovuled. Maytenus consists of evergreen, unarmed plants: lvs. alternate, often 2-ranked, stalked, leathery, serrate: fls. small, white, yellow or reddish, axillary, solitary, clustered or cymose; calyx 5-cut; petals and stamens 5, the latter inserted under the disk; disk orbicular, wavy-margined: style none or columnar: capsule leathery, loculicidally 2-3-valved.

1381. Maximiliana regia.

M. Boaria is a beautiful evergreen tree, of graceful habit; in Calif. 15-25 ft. high, but in Chile said to attain 100 ft.: branchlets pendulous: lvs. small: fls. minute, greenish, inconspicuous: aril scarlet. Perfectly hardy in Calif. as far north as San Francisco, and highly valued for ornamental planting; recommended as a street and avenue tree: timber extremely hard. Propagated readily from seeds, which are produced in abundance, or from suckers.

Boària, Molina (*M. Chilénsis*, DC.). MAYTEN. Fig. 1382. Lvs. ovate-lanceolate, thin, glandular-serrate, glabrous: fls. small, axillary, clustered, polygamous, the males with 5 calyx teeth, petals and stamens: capsule the size of a pea, 2-valved, 2-seeded. Chile. B.R. 20:1702.

J. BURTT DAVY.

MAZE. See *Labyrinth.*

MEADOW BEAUTY. *Rhexia.* **M. Foxtail.** *Alopecurus pratensis* (a meadow grass). **M. Pink.** *Dianthus deltoides.* **M. Rue.** *Thalictrum.* **M. Saffron.** *Colchicum.* **M. Sweet.** *Ulmaria.* **M. Tulip.** *Calochortus.*

MECONÓPSIS (Greek, *poppy-like*). *Papaveràceæ.* About 10 species of herbs, natives of the Himalayas, China, Europe and western North America. The Welsh Poppy, *M. Cambrica*, is suitable for rockeries, grows about a foot high, and has rather large, pale yellow, 4-petaled fls. borne in summer. The genus is nearest to Argemone, but does not have prickly lvs. Perennial or rarely annual: lvs. entire or rarely lobed or dissected: fls. long-peduncled, yellow, purple or blue: ovary ovoid, with a short but distinct style and a stigma of 4-6 rays. J. B. Keller writes that the Welsh Poppy is of easy cultivation in ordinary garden soil and sunny situation, and is prop. by seed or division.

Cámbrica, Vig. WELSH POPPY. Perennial: stems slender: lvs. long-stalked, pale green, slightly hairy, pinnate, dentate, with 5-7 segments. Rocky woods and shady places, western Eu. G.C. III. 19:671 (a double-fld. form).

MEDÈOLA (named after the sorceress Medea, for its supposed great medicinal virtues). *Liliàceæ.* INDIAN CUCUMBER ROOT, from the taste of the edible root. This native perennial herb has 2 whorls of lvs. and bears small and not very showy fls. It is offered by some dealers in native plants. Medeola is nearest to Trillium. The fls. are umbellate, the perianth segments all alike, colored and deciduous.

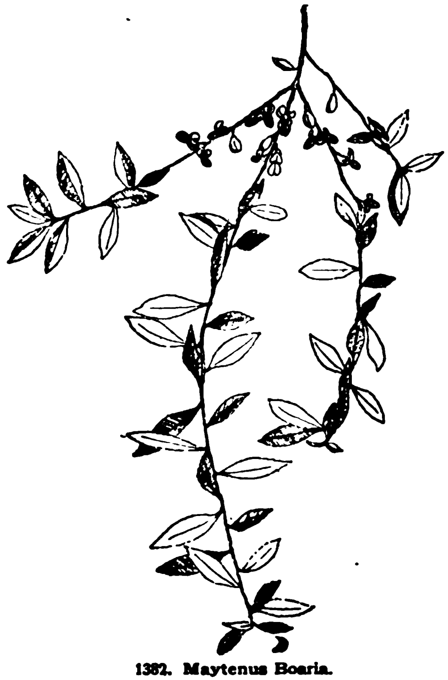
Virginiàna, Linn. Fig. 1383. Stem slender, 1-3 ft. high, clothed with flocculent deciduous wool: lower whorl of lvs. 5-9, obovate-lanceolate, pointed, netted-veiny, lightly parallel-ribbed, sessile; upper whorl of 3-5, smaller, ovate lvs. at top subtending a sessile umbel of small, recurved fls. June. Boggy soil, New England to Minn., Ind. and southward. B.M. 1316. D. 129.

M. asparagoìdes, Linn.=Asparagus medeoloides.

MEDICÀGO (name originally from the country Media). *Leguminòsæ.* Forty to 50 herbs (rarely shrubs) in Europe, Asia and Africa, with small pinnately 3-foliolate lvs. and denticulate lfts., and mostly small, purple or yellow fls. in heads or short racemes: stamens 9 and 1, diadelphous: fr. a small spiral or curved, rough or pubescent indehiscent 1- to few-seeded pod: fl. with an obovate or oblong standard and obtuse mostly short keel. Three or 4 species have become weeds in the East. A few are somewhat cult. for ornament. The one important species, from an agricultural point of view, is Alfalfa. One species (and perhaps more) is cult. for the odd pods, which are sometimes used by Old World gardeners as surprises or jokes, and are occasionally grown in this country as oddities. Some of the Medicagoes simulate clovers in appearance, but the twisted or spiral pods distinguish them.

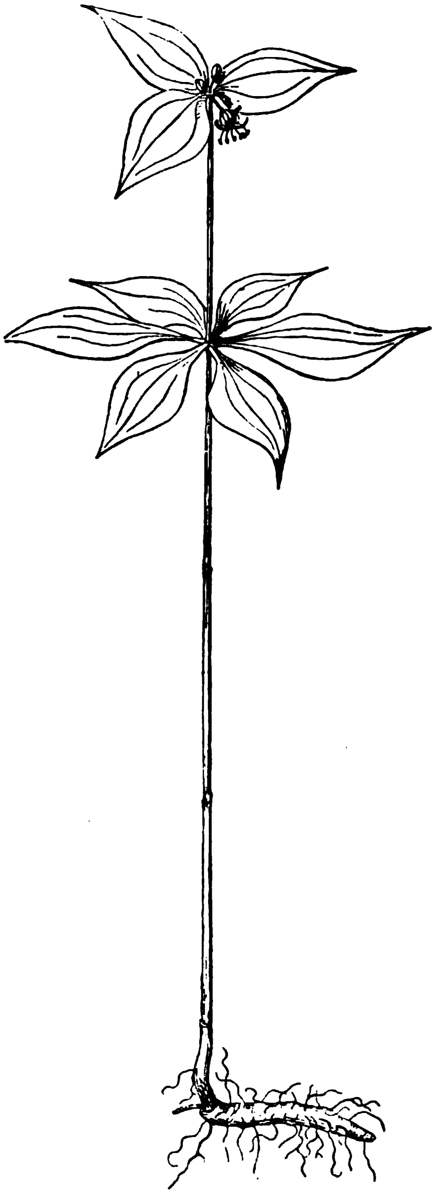
A. *Flowers purple.*

sativa, Linn. ALFALFA. LUCERNE. Fig. 1384. Perennial, glabrous, growing erect 1-3 ft. and making a long tap-root: lfts. small, linear, oblong to ovate-oblong, prominently toothed towards the top: stipules awl-like, conspicuous, entire: fls. in short, axillary racemes:



1382. Maytenus Boaria.
Showing the dehiscing fruit.

pods slightly pubescent, with two or three spirals. Eu. —Now widely cult., particularly in dry regions, as a hay and pasture, being to the West what red clover is to the Northeast. See *Alfalfa*. A hardier and drought-resisting race (known as var. **Turkestánica,** Hort.) was introduced from central Asia in 1898 by N. E. Hansen, under the auspices of the U. S. Dept. Agric. (see Hansen, Amer. Agric. Feb. 24, 1900; Circular 25, Division of Agrostology, U. S. Dept. Agric.).



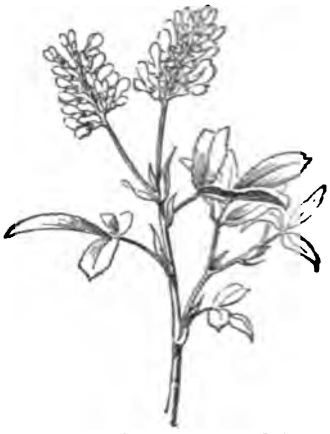
1383. Medeola Virginiana, the Indian Cucumber Root. (×½.) (See p. 997.)

AA. *Fls. yellow.*

B. *Plant annual and herbaceous.*

lupulina, Linn. Black or Hop Medick. Nonesuch. Diffuse, the branches often rooting and becoming 2–3 ft. long, deep-rooted, and difficult to pull up: plant glabrous or slightly pubescent: lfts. oval to orbicular, toothed: stipules broad and toothed: fls. small, light yellow, in pedunculate heads: fr. nearly glabrous, spiral, becoming black. Eu.—Extensively naturalized. Has the appearance of a clover. The yellow clovers with which it is likely to be confounded have larger heads, which soon become dry and papery, and the stipules are entire. It is sometimes used as a forage or hay plant. Of no ornamental value.

prostràta, Jacq. Stem prostrate: lfts. linear, dentate at the apex: stipules linear-subulate: pod glabrous, spirally contorted, 2-seeded, black. S. Eu. —Advertised as an ornamental plant. *M. elegans*, a name for a low, yellow-fld. species, is also in the trade; it may be any one of 4 or 5 species.



1384. Medicago sativa—Alfalfa. (×⅓.)

scutellàta, Mill. Snails. Erect or spreading, soft-pubescent: lfts. broadly obovate or the upper ones broadly oblong, prominently toothed: stipules falcate, toothed at the base: fls. small, solitary or nearly so: pod large and prominently reticulated, ½ in. across, like a snail shell. Eu.—Grown for the odd snail-like pods, which are used as surprises. See the article *Caterpillars.*

BB. *Plant perennial and woody.*

arbòrea, Linn. Tree Alfalfa. Moon Trefoil. Two to 8 ft. tall, with hard black wood: lfts. oval to obovate, light green, toothed at the top: stipules linear-acute, entire: fls. orange-yellow, in rather loose, axillary, peduncled clusters: pod spiral, 2–3-seeded. S. Eu. L.B.C. 14:1379.—Offered as an ornamental plant in S. Calif.

L. H. B.

MEDICK. See *Medicago.*

MEDINÍLLA (after José de Medinilla y Pineda, governor of the Ladrones). *Melastomàceæ.* A genus of 98 species of tropical plants, mostly from the East Indies and Pacific islands. *M. magnifica* is one of the most gorgeous tropical plants in cultivation, and one of the most desirable for amateurs who have hothouses. It is a native of the Philippines. It has handsome broad, shining, leathery foliage and coral-red, 5-petaled fls., each about 1 in. across, which are borne in pendulous pyramidal panicles sometimes a foot long, and bearing 100–150 fls. The axis and branches of the panicle are pinkish, and the same color tinges the large, showy bracts, which are sometimes 4 in. long. Hooker says: "Its most beautiful state is, perhaps, before the full perfection of the fls., when the large imbricated bracts begin to separate and allow the buds to be partially seen. As the expansion of the blossoms advances, the upper bracts fall off, but the lower ones remain and become reflexed." This truly magnificent plant flowers copiously when only 2 or 3 ft. high, and a large well-kept specimen in flower is a sight that is never to be forgotten. The numerous long, bent, purple anthers, with their yellow filaments, form an additional feature of interest.

Medinilla is distinguished from allied genera (none of which has garden value) chiefly by the curious appendages of the stamens. The stamens are 8, 10 or 12, the anterior connective, 2-lobed or 2-spurred, the posterior one usually setose or 1–2-lobed or 1-spurred. Medinillas are branching shrubs, erect or climbing: lvs. mostly opposite or whorled, entire, fleshy: fls. white or rose, with or without bracts, in panicles or cymes. Cogniaux in DC. Mon. Phan. 7:572–602 (1891). The 2 species described below are glabrous, with opposite, sessile lvs. and long, terminal, pendulous, bracted panicles, with floral parts in 5's.

A. *Fls. coral-red or rosy pink.*

magnifica, Lindl. Figs. 1385–6. Lvs. with 9–13 nerves, which run from various points along the midrib to the margin or apex, ovate or ovate-oblong: bracts 1–4 in. long. Philippines. B.M. 4533. F.S. 6:572 and 9:968 (splendid). Gn. 51, p. 394. G.C. II. 2:421. R.H. 1857, pp. 319, 343, and 1896, pp. 102, 103. A.F. 7:1047.—Other interesting features are the whorled branches, each one 4-ridged or winged, and the dense ring of short, fleshy processes at the joints between the lvs. It can be propagated by seeds or cuttings of young wood in heat.

AA. *Fls. white.*

Cúrtisii, Hook. Lvs with 2 nerves beside the midrib which run from the base to the apex of the leaf: bracts about 3 lines long. Sumatra. B.M. 6730. G.C. II. 20:621.—John Saul says it blooms in autumn. W. M.

Medinilla magnifica is a fine stove plant, even when not in flower. It remains in bloom from April to July. The writer has kept a tree-shaped specimen for more than twenty years, during which time it has never failed to bloom annually. In alternate seasons the fls. have been more abundant, showing that the plant needs a rest. After flowering, the specimen may be placed outdoors in a partly shaded position, where high winds cannot damage the foliage. In September, it should be placed in a conservatory with a night temperature of 55°. When growing vigorously it likes plenty of weak liquid cow manure and guano alternately. It must be constantly watched for mealy bug, as it is almost impossible to dislodge this pest after the racemes have begun to form. F. L. Harris.

1385. Medinilla magnifica. A young specimen.

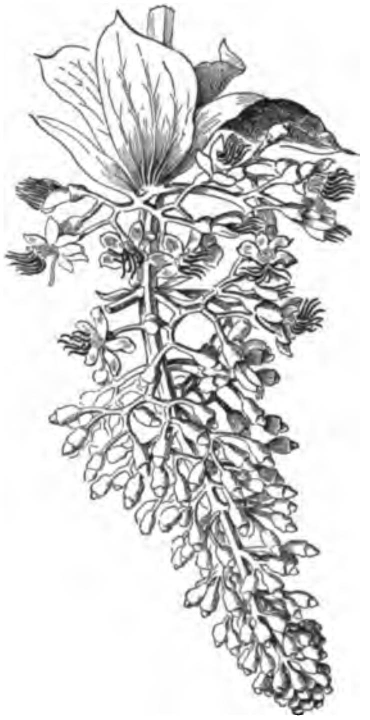
MEDLAR. See *Mespilus*. The Loquat is sometimes erroneously called Medlar. For Japanese Medlar, see *Photinia*.

MEDUSA'S HEAD. *Euphorbia Caput-Medusæ.*

MEGARRHÌZA (Greek for *big root*). *Cucurbitàceæ.* By Bentham & Hooker, and also by Cogniaux (DC. Monogr. Phaner. 3) this genus is referred to Echinocystis, but Watson (Bot. Calif. 1, p. 241) distinguishes it from that genus "by its thick perennial roots, its large, turgid, immarginate seeds and its thick, fleshy cotyledons which remain under ground in germination. The fruit in some species appears to be wholly indehiscent." There are five species described in the Botany of California. One of these, **M. Califórnica,** Torr. (*Echinocystis fabacea*, Naud.), is sometimes grown in fine collections and botanic gardens. It is a tendril-climber, reaching 20 to 30 ft. in its native haunts: lvs. deeply 5–7-lobed: fls. monœcious: fr. densely spinose, globose or ovoid, 2 in. long: seed obovoid, nearly 1 in. long and half or more as broad, margined by a narrow groove or dark line. S. Calif. Odd in germination (see Gray, Amer. Journ. Sci. 1877).

MEGASÈA. See *Saxifraga*.

MELALEÙCA (Greek, *melas*, black, and *leukos*, white; from the black trunk and white branches of one of the species). *Myrtàceæ.* This genus comprises about 100 species of Australian trees and shrubs, many of which are considered useful for fixing coast sands and holding muddy shores. The trees live in salty ground and water, much as mangroves do, and some are grown in swamps as a corrective of fever conditions. They transplant easily and have close-grained, hard, durable timber. Lvs. alternate, rarely opposite, entire, lanceolate or linear, flat or subterete, with 1–3 or many nerves: bracts deciduous: fls. in heads or spikes, each sessile in the axil of a floral leaf, their parts in 5's; calyx tube subglobose; lobes imbricate or open; petals spreading, deciduous; stamens indefinite in number, more or less united at their bases into 5 bundles opposite the petals; anthers versatile, the cells parallel and bursting longitudinally: ovary inferior or half inferior, enclosed in the calyx tube, usually with many ovules in each cell. Several species are cultivated in S. Calif. Sometimes called Bottle-brush trees, from their resemblance to the allied Callistemons. Flora Australiensis, 3:123.


1386. Medinilla magnifica (×⅓).

A. *Lvs. mostly alternate.*

Leucadéndron, Linn. (*M. Cajapùti*, Roxb.). The Cajaput Tree. The most widely distributed of all the species, with many changeable and uncertain variations, found throughout tropical Asia, especially the Indian Archipelago. The plants range in size from shrubs to trees 80 ft. high, the large trees having slender, pendulous branches, the small trees and shrubs rigid, erect branches: lvs. often vertical, elliptical or lanceolate, straight, oblique or falcate, acuminate, acute or obtuse, when broad 2–4 in. long, when narrow 6–8 in. long, narrowed into a petiole, thin or rigid: fl.-spikes more or less interrupted, solitary or 2 or 3 together, from less than 2 to more than 6 in. long: fls. numerous, white, elongated; stamens greenish yellow, whitish, pink or purple, glabrous, 5–9 in each bundle, less than ½ in. long; claws sometimes very short, sometimes exceeding the petals, each with 5–8 filaments at the end. The lvs. yield the well-known green aromatic cajaput oil used in medicine. The bark is pale buff, in many thin, easily separated layers; it is very durable, lasting longer than timber, and is said to be almost impervious to water; it is valuable for packing fruits and is used for roofs and for boats. The tree withstands winds, drought and slight frosts and grows where the Eucalpytus fails. Von Müller recommends it for planting where yellow fever occurs. Sometimes called the Paper Bark or Swamp Tea tree. G.M. 40:798.

AA. *Lvs mostly in whorls of 3–5.*

micromèra, Schau. Lvs. closely appressed, ovate, scale-like, but thick, peltately attached, rarely above ½ line long: fls. sulfur-yellow, the males small, in globular, terminal heads, the axils soon growing out into a leafy shoot: fruiting heads dense, globular, the calices open.

AAA. *Lvs. mostly opposite.*

B. *Margins of lvs. recurved.*

hypericifòlia, Smith. Lvs. opposite, lanceolate or oblong, rather thin, with recurved margins and prominent midrib ¾–1½ in. long: fls. large, rich red, in cylindrical or oblong dense spikes; stamens over ½ in. long; staminal claws long. L.B. C. 2:199.—This species belongs to a series in which the stamens are over ½ in. long, while in the other 6 series the stamens never exceed ½ in.

BB. *Margin of lvs. not recurved.*

decussàta, R. Br. Tall shrub, sometimes 20 ft. high: lvs. mostly opposite, often decussate on the smaller branches, oblong-lanceolate or linear, 3–6 lines long, rigid: fls. rather small, pink; when in oblong or almost globular lateral heads or spikes are usually barren, and fertile when in oblong or cylindrical interrupted spikes forming the base of leafy branches; stamens not above 3 lines long, very shortly united in bundles of 10–15; calyx lobes more or less scarious and deciduous or wearing off when in fruit, attached by the broad base, more or less immersed when in fruit in the thickened rachis. B.M. 2268. L.B.C. 13:1208.

M. B. COULSTON.

MELÁNTHIUM (Greek, *black flower;* from the darker color which the persistent perianth assumes on fading). *Liliàceæ.* Leafy perennial herbs 2–5 ft. high, with thick rootstocks: lvs. linear to oblanceolate or oval: fls. greenish, white or cream-colored, borne in a large, open terminal panicle. The genus is nearest to Veratrum, but the sepals of the latter are not clawed as they are in Melanthium. Perianth segments usually oblong or oblanceolate, with or without glands at the top of the claw. Of 6 species, 2 are African, 1 Siberian and 3 North American, only 1 of the latter being in the trade.

Virginicum, Linn. BUNCH FLOWER. Stem rather slender, leafy: lvs. linear, 1 ft. or less long: panicles 6–18 in. long: fls. 6–10 lines across; double gland at top of claw. July. Marshy woodlands and meadows from New England to Fla. and Minn. to Tex. B.M. 985 (*Helonias Virginica*).—Int. by H. P. Kelsey 1891. A showy and striking plant.

M. júnceum is advertised by Krelage, of Haarlem, but its botanical position is to be determined.

MELASPHÆRULA (a little black sphere; referring to the bulblets on the stem). *Iridàceæ.* A genus of one species from the Cape of Good Hope, a small, rare bulbous plant procurable from Dutch bulb-growers. It belongs to the Ixia tribe, in which the flowers are spicate, not fugitive, and never more than 1 to a spathe. It resembles Ixia in having a regular perianth and simple style branches, but belongs to a different group of genera in which the stamens are one-sided and arched. Baker places it between Crocosma and Tritonia, differing from them in having a small perianth without any tube and very acuminate segments. Baker, Irideæ, 1892, and Flora Capensis, vol. 6. For culture, see *Bulbs* and *Ixia.*

graminea, Ker. Corm globose, ½ in. in diam.: stem very slender, 1 ft. or more long: lvs. about 6 in a 2-ranked, basal rosette, linear, ½–1 ft. long: spikes few-fld., panicled: fls. yellowish green, veined with purplish black, ½–¾ in. across. Spring. B.M. 615.

1387. Umbrella-tree—Melia Azedarach, var. umbraculiformis.

MELASTÒMA (Greek for *black* and *mouth;* alluding to the color left in the mouth when the berries of some species are eaten). This genus, which gives name to the great family Melastomaceæ, with 2,000 species, is little known in cult. It is not the most important genus of the family, either horticulturally or in number of species. Cogniaux, the latest monographer (DC. Monogr. Phaner. 7), admits 37 species. The larger part of melastomaceous plants are of tropical America, but the true Melastomas are natives to tropical Asia, Australia and Oceanica. They are shrubs or rarely small trees: lvs. opposite, petiolate, oblong or lanceolate, thick and entire, strongly nerved lengthwise, often handsomely colored: fls. solitary or fascicled on the ends of the branches, purple or rose (rarely white), large and showy; calyx mostly 5-lobed; petals usually 5 and often unequal, ciliate on the back; stamens 10 as a rule, very strongly unequal, part of them being short and small: fr. a leathery or fleshy berry, breaking irregularly, 5–7-loculed and containing many small spiral seeds. For culture, see *Medinilla.* Nearly all tropical melastomaceous plants require a high temperature, partial shade and considerable moisture. Prop. by cuttings of firm wood. Advertized in S. Calif.

A. *Lvs. strongly 5-nerved.*

decémfidum, Roxbg. (*M. sanguineum*, D. Don. *M. Malabáthricum*, Sims, not Linn.). Three to 4 ft.: branches subterete and hirsute: lvs. lanceolate or lance-oblong, long-acuminate, the nerves (or at least some of them) and the petioles often red: fls. 1–3, large, nearly or quite 2 in. across, the petals rose-colored and retuse. Java to China. B.M. 529 and 2241.

AA. *Lvs. strongly 7-nerved.*

cándidum, D. Don (*M. Malabáthricum*, B.R. 8:672, not Linn.). Branches 4-angled, the younger ones pubescent, as also the petioles: lvs. ovate-acute, setulose above, villose beneath: fls. 3–7 in a cyme, rose-colored (sometimes white ?), about the size of those of *M. decemfidum;* calyx-lobes shorter than the tube. China.

Malabáthricum, Linn. Differs from the last in having the calyx-lobes about equal to the tube, or sometimes even longer: lvs. oblong or ovate-oblong, acute or short-acuminate, sparsely setulose, above and beneath: fls. corymbose, purple, much smaller than in the last two.

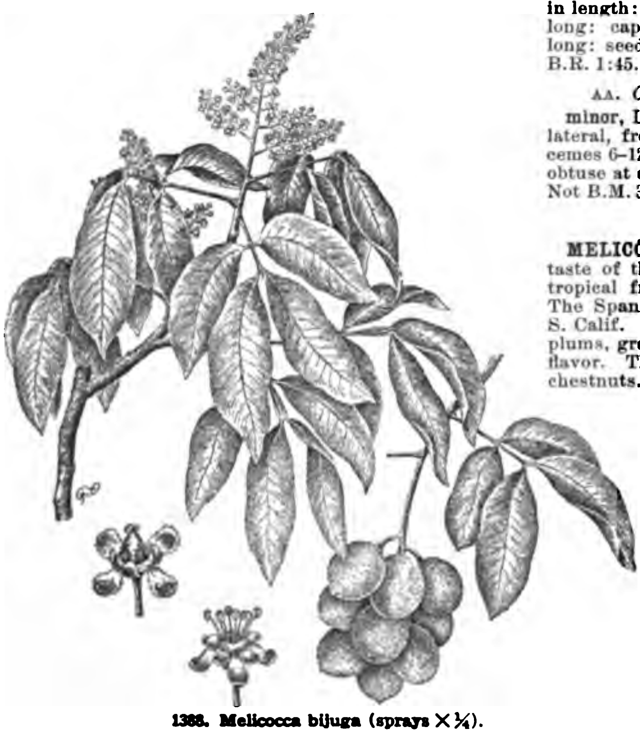
E. India to Austral.—Probably the *M. Malabathricum* of horticulturists is one of the above species. Not known to be in the Amer. trade. L. H. B.

MÈLIA (ancient Greek name). *Meliàceæ*. Trees, from 30 to 40 feet high: lvs. deciduous, doubly pinnate as a rule, the lfts. acuminate, glabrous: fls. in graceful panicles; sepals 3–5; petals 5 or 6; stamens monadelphous, 10–12, of two different lengths: ovary with several locules, topped with a single style: fr. a small, indehiscent drupe. Species 2 or 3, of Asia and Australia.

A. *Lvs. more than once-pinnate.*

Azédarach, Linn. This is the typical species as introduced in the southern states early in the last century. It is a native of India and Persia, hence its various local names, as Pride of India, Indian Lilac, Chinaberry tree, etc. It has become naturalized throughout the South, the seeds germinating freely. It grows with great rapidity, and forms one of the most desirable shade trees, both from the bright green tint of the foliage, which is retained until late in the autumn, and also from the fragrance of the numerous, lilac-colored flowers, which are produced during April. These are succeeded by an abundant crop of berries, of a yellowish, translucent color, which are readily eaten by cattle and birds. The wood, although coarse, is very durable. The tree can withstand a low temperature, but a cold of zero will injure it. Several forms have been found, a white-flowering and one with finely-cut leaves, with the segments of the lfts. cut in narrow divisions. These forms are not constant, the seedlings frequently reverting to the typical species. In all forms of *M. Azedarach*, the lvs. are 2- or 3-pinnate, the ultimate lfts. ovate or lanceolate, and varying from serrate to very nearly entire. B.M. 1066.

Var. **umbraculifórmis,** Hort. TEXAS UMBRELLA TREE. Fig. 1387. The first tree that came to notice was found near the battle-field of San Jacinto, Texas, but with no record of its introduction there. If the flowers are not cross-pollinated with the common sort, the percentage of seedlings which reproduce the exact umbrella shape seldom varies; hence it is supposed by some to be a distinct species. The lfts. are less broad than in *M. Azedarach*, and the branches erect, and, in a manner, radiating from the trunk, the drooping foliage giving the tree the appearance of a gigantic umbrella. Mn. 8, p. 73.



1388. Melicocca bijuga (sprays × ¼).

AA. *Leaves once-pinnate.*

Azadiráchta, Linn. (*M. Japónica*, Hassk.). Large tree, sometimes 50 ft.: lvs. broad, with 9–15 lance-acuminate, oblique, more or less serrate lfts.: fls. white, fragrant: foliage crowded near the ends of the branches. India.—Not hardy in the Middle South.

M. floribúnda, Carr. (R.H. 1872:470) is probably a form of M. Azedarach. It is more precocious and very floriferous.—*M. sempérvirens*, Sw. From Jamaica. A low-growing tree with leaves deeply incised. Flowers in axillary panicles, small, light lilac, fragrant, in constant succession. A greenhouse species. Probably only a form of *M. Azedarach*. B.R. 8:643.

P. J. BERCKMANS and L. H. B.

MELIÁNTHUS (*mel*, honey, and *anthos*, flower). *Sapindàceæ*. About 6 species of evergreen shrubs, natives of South Africa. Can be grown out-of-doors in S. Calif. Foliage has a disagreeable odor when bruised: lvs. alternate, stipulate, odd-pinnate; lfts. unequal-sided, toothed: fls. in axillary and terminal racemes, secreting honey plentifully; calyx laterally compressed, with or without a sac-like protuberance at the base, and a nectar-bearing gland within; petals 5, the anterior one abortive; stamens 4, didynamous. *M. Himalayanus* is *M. major*, which has been introduced into S. Asia.

A. *Calyx gibbous at base.*

màjor, Linn. Stem flexuous, glabrous, sometimes 10 ft. or more in height, with a widely creeping root: lvs. gray, a foot or more long, the upper ones smaller; stipules grown together into one large, intra-axillary piece, attached to the lower part of the petiole; lfts. 9–11, 3–4 in. long, 2 in. wide: racemes densely-fld., 1 ft. or more in length: bracts ovate, acuminate: fls. red-brown, 1 in. long: capsule papery, 4-lobed at the apex, 1–1¼ in. long: seeds 2 in each cell, black and shining. Cape. B.R. 1:45. R.H. 1867, p. 131.

AA. *Calyx not conspicuously gibbous at base.*

minor, Linn. Lvs. 5–6 in. long; stipules 2, subulate, lateral, free; lfts. 1½–2 in. long, 6–10 lines wide: racemes 6–12 in. long, subterminal: fls. dull red: capsule obtuse at each end, scarcely 4-lobed, 8 lines long. Cape. Not B.M. 301, which is *M. comosus*.

M. B. COULSTON.

MELICÓCCA (Greek, *honey berry;* referring to the taste of the fruit). *Sapindàceæ*. Two or 3 species of tropical fruit trees, natives of Guiana and Trinidad. The Spanish Lime, *M. bijuga*, is cult. in S. Fla. and S. Calif. Its fruits are about the size and shape of plums, green or yellow, and have a pleasant, grape-like flavor. The large seeds are sometimes roasted like chestnuts. The tree grows slowly, attaining 20–60 ft., and bears freely. It can be fruited in the North under glass. Generic characters: lvs. abruptly pinnate: racemes divided: calyx 4-parted; segments imbricated: petals 4; stamens 8; disk complete; stigma peltate, subsessile: ovary 2-celled: berry 1–2-seeded.

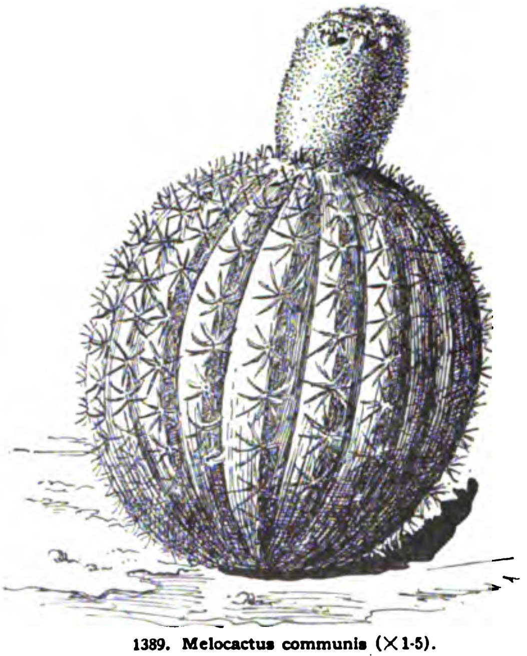
bijùga, Linn. SPANISH LIME or GINEP. Fig. 1388. Lfts. in 2 pairs, elliptical or elliptic-lanceolate, entire, glabrous: fls. whitish, in terminal racemes. Naturalized in the West Indies. Bears several degrees of frost. The foliage is distinct, the compound lvs. with winged petioles resembling those of *Sapindus saponaria*, the West Indian Soap-berry.

MELILÒTUS (Greek for *honey lotus*). *Leguminòsæ*. SWEET CLOVER. Perhaps a dozen species of annual or biennial tall-growing, sweet-smelling herbs, widely distributed in temperate and subtropical regions. Lvs. pinnately 3-foliolate, the lfts. toothed and mostly narrow: fls. small, white or yellow, in slender, long-stalked, axillary racemes; calyx teeth short and nearly equal; standard oblong or oblong-obovate; keel obtuse: fr. a small. few-seeded, not twisted, but more or less reticulated flattish pod. Two species, **M. officinàlis**, Lam. (yellow-fld.), and **M. álba**, Desv. (white-fld.), have become weeds along roadsides and in waste places.

The latter, *M. alba*, is the commoner. It is an erect herb, often higher than a man, flowering abundantly in spring and early summer. It is biennial. It is said to prefer soils rich in lime, and it thrives on poor and dry soils. Under the name of Bokhara clover and sweet clover, it is grown somewhat as a forage plant. Cattle come to like it for grazing, particularly if turned onto it early in the season, before other herbage is attractive. It may also be cut for hay, particularly the second year. About 10 lbs. of seed is required per acre. It is an excellent bee plant. L. H. B.

MELÍSSA (Greek, *bee;* because the bees are fond of Balm). *Labiàtæ.* About 8 species of hardy perennial herbs from Europe and western Asia. *M. officinalis* is Balm (which see), a sweet herb, with white or pale yellow fls. A variegated form is cult. for ornament. It has silvery white markings. *M. Patavina*, Benth.= *Calamintha Patavina*, Hort. This has light purple fls., and may be told from *C. grandiflora* and *officinalis* by the calyx being bulged or gibbous at the base. Melissas have dentate lvs.: whorls few-fld., lax, axillary, secund: fls. white or yellowish; corolla tube recurved-ascending below the middle.

MELOCÁCTUS (*melon-cactus*, referring to the shape of the plant-body). *Cactàceæ.* Stems globose or ovoid, with vertical ribs, crowned at maturity with a "cephalium"—a prolongation of the axis densely covered with small tubercles, imbedded in wool and bearing in their axils small flowers and berries. The plant has the appearance of an Echinopsis surmounted by a Mammillaria.



1389. Melocactus communis (×1-5).

commùnis, Link & Otto. Fig. 1389. Ribs 10–20, acute: areolæ nearly 1 in. apart: radial spines 8–11, straight or curved, subulate; centrals 1–4: cephalium at first low, hemispherical, becoming cylindrical in time, reaching a height of 8 in.; the dense wool of the cephalium is pierced by many red or brown bristles: fls. red, slender: fr. ⅔ in. long, crowned by the persistent remains of the flower, red. West Indian islands. Called there "Turk's Head." B.M. 3090. KATHARINE BRANDEGEE.

MELON. See *Muskmelon* and *Watermelon; also Citrullus* and *Cucumis.* **M. Papaw.** See *Carica Papaya.* **M. Shrub.** See *Solanum muricatum.* **Chinese Preserving Melon** is *Benincasa.*

MELÒTHRIA (probably a name for a bryony-like plant; *melon* is Greek for apple, which may refer to the shape of the fruit). *Cucurbitàceæ.* About 54 species of slender herbaceous vines, climbing or trailing, annual or perennial, with small yellow or white fls., found in the warmer parts of the world. Three kinds are known to the trade as *M. scabra*, *Mukia scabrella* and *Pilogyne suavis*, the last being perhaps the best. These three are slender, but rapid-growing, half-hardy, annual climbers, which may be grown indoors in winter, but preferably outdoors in summer for covering unsightly objects. They are presumably more attractive in fruit than in flower.

The latest monographer, Cogniaux in DC. Mon. Phan. Vol. 3, 1881, makes three sections of the genus. *M. scabra* belongs to the first, *M. punctata* to the second and *M. Maderaspatana* to the third. *M. punctata* has sensitive tendrils.

Section I. EUMELOTHRIA. Fls. usually monœcious, males mostly racemose; anthers subsessile: fr. mostly with long and slender peduncles: seeds usually not margined.

Section II. SOLENA. Fls. mostly diœcious, males corymbose; anthers borne on rather long filaments, the connective not produced: fr. mostly short-peduncled: seeds mostly margined.

Section III. MUKIA. Fls. monœcious, males clustered; anthers subsessile, the connective apiculate: fr. subsessile: seeds margined, usually pitted.

scàbra, Naud. Lvs. rigid, entire or acutely 5-lobed; tendrils unbranched: anthers roundish, with a wide connective, the cells straight, not plicate: fr. ovoid or ovoid-oblong, obtuse, 3-celled, rather large (1 in. long, ½ in. thick), with broad parallel stripes of white and green. Mexico.

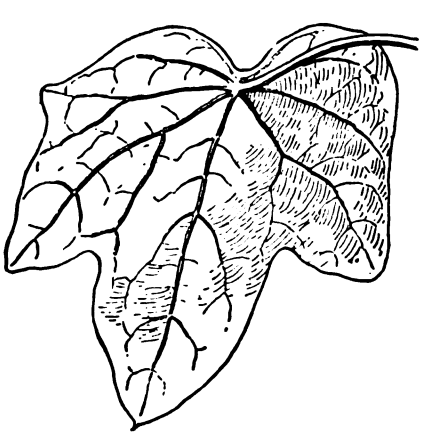
punctàta, Cogn. (*Pilógyne suàvis*, Schrad.). Lvs. membranous, cordate, angled or slightly 3–5-lobed, white-spotted above, pilose, short-hairy or scabrous below, margin remotely denticulate: fr. brown, lightly pitted, about 3 lines thick: seeds small, about 2 lines long, strongly compressed. S. Africa.—Int. 1890 by Henderson & Co. as the Oak-leaved Climber. *Melothria punctata* is a beautiful climbing herbaceous perennial, better known as *Pilogyne suavis*, and sometimes called *Zehneria suavis.* Even when protected, it is too tender to stand the northern winters. It blooms in clusters; fls. small, white and star-shape, with a strong musk fragrance: lvs. green, small and glossy. Being a very rapid grower, it is desirable for covering verandas or for house culture. It will do well in any part of a living room where it has light. It will grow as much as 16 feet high in one summer by having a liberal supply of water every day and liquid manure once a week. After growing outdoors it can be cut down to 6 inches, potted and taken into the house for the winter. In the spring it can be cut back, again planted out and it will do well. The roots can almost be called tuberous, and can be kept dormant during the winter, the same as Dahlias, buried in sand in a cool, dry place, free from frost. Rapidly increased by cuttings.

Maderaspàtana, Cogn. (*Mùkia scabrélla*, Arn.). Lvs. scabrous or short-hairy beneath: fr. small, globose: seeds pitted. Trop. Asia and Afr.—"Fruits reddish when ripe." *J. M. Thorburn & Co.* JAMES VICK and W. M.

MENÍSCIUM (Greek, *a crescent;* referring to the shape of the sori). *Polypodiàceæ.* A small genus of about 10 tropical species, with simple or pinnate lvs. and the main veins united by successive transverse arches, on which the naked sori are borne.

reticulàtum, Swz. Stalks 1–3 ft. long, stout: lvs. 2–4 ft. long, 1 ft. or more wide, pinnate; pinnæ 1–4 in. wide, with an acuminate apex, naked or slightly pubescent; main veins 1–1½ lines apart, with 8–12 transverse arches. Mexico and W. Indies to Brazil. L. M. UNDERWOOD.

MENISPÉRMUM (Greek, *moonseed*). *Menispermàceæ.* Moonseed. As conceived by the early botanists, Menispermum contained many species which are now referred to Cocculus, Abuta, Cissampelos, Tinospora, Anamirta and other genera. The genus is now considered to be bitypic, one species occurring in N. America and the other in Siberia, China and Japan. Moonseeds are twining woody vines, with alternate long-petioled lvs., which are peltate near the margin, and axillary or super-axillary panicles or cymes of small diœcious fls.: fr. a compressed berry-like drupe, containing a flattened crescent-shaped or curved stone (whence the name Moonseed): stamens 9-24, with 4-loculed anthers in the staminate fls., 6 and sterile in the pistillate fls.; pistils 2-4, with broad stigmas; sepals 4-8, in 2 series; petals 6-8, shorter than the sepals. Both the Moonseeds are neat and interesting vines, and are hardy in the northern states and Ontario. Propagated readily by seeds; or plants of *M. Canadense* may be dug from the wild. Cuttings of ripened wood may also be used.



1390. Leaf of Menispermum Canadense (× ⅓).

Canadénse, Linn. Common Moonseed. Fig. 1390. Stems slender and terete, flocculent-pubescent when young, but becoming glabrous, twining 10 ft. or more high: lvs. round-ovate to ovate-cordate, sometimes entire, but usually angulate-lobed, the long petiole attached just inside the margin: fls. greenish white, in loose, straggling panicles, the sepals and petals usually 6, the stamens in the terminal fls. 17-20 and in the lateral ones 11 or 12: fr. bluish black, ¼ in. in diam., resembling small grapes. Rich soils in thickets and lowlands, Quebec to Manitoba and south to Ga. B.M. 1910.

Dahùricum, DC. In habit much like the above: lvs. smaller, deeper green, cordate and angular: fls. in cymes, yellowish, the terminal ones with 6 sepals, 9 or 10 petals and about 20 stamens, the lateral ones with 4 sepals, 6 petals and about 12 stamens. Eastern Asia.—Variable. Rarely planted in this country.

L. H. B

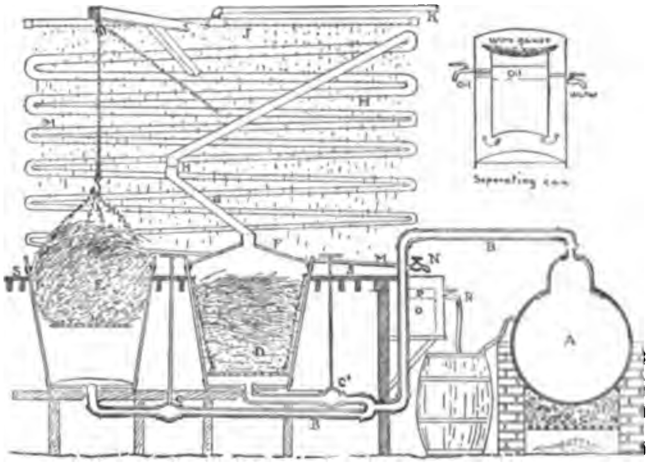
MÉNTHA (from the Greek name of the nymph Minthe). *Labiàtæ.* The term Mint, often applied to various species of the Labiatæ, is most frequently used to designate plants of the genus Mentha. This genus is characterized by its square stems and opposite simple leaves, in common with others of the order, and especially by its aromatic fragrance, its small purple, pink or white flowers, with regular calyx, slightly irregular corolla and four anther-bearing stamens, crowded in axillary whorls and the whorls often in terminal spikes.

Some of the species hybridize freely, producing innumerable intergrading forms which make the limitation of certain species difficult. Many forms have been described, and the synonymy is extensive. About 30 species are now recognized, all native in the north temperate zone, 12 being native or naturalized in North America. Six species are cultivated more or less for the production of aromatic essential oil, which is found in all parts of the herb, and especially in minute globules on the surface of the leaves and calyx.

Peppermint, the most important economic species of Mint, ranks as one of the most important of all plants in the production of essential oils. It was originally native in Great Britain and possibly in continental Europe, but is now widely naturalized, growing in many places on both continents like a native plant. There is no record of it in America previous to its introduction to Connecticut in the early part of the eighteenth century. From there it was taken to western New York and to the Western Reserve in Ohio, and in 1835 "roots" were taken from Ohio to Pigeon Prairie, in Michigan, where the industry has grown to larger proportions than anywhere else. Peppermint is now cultivated commercially in southwestern Michigan and adjacent parts of northern Indiana, Wayne county, New York, and in Mitcham, Surrey and Lincolnshire, England, and in Saxony.

Peppermint plants may be grown on any land that will produce good crops of corn, but its cultivation is most profitable on muck soils of reclaimed swamps. It is an exhaustive crop, and on upland is rarely included in the rotation more often than once in five years. On deep, rich muck soils it is often grown consecutively 6 years or more with no apparent diminution in yield. Peppermint is propagated by pieces of running rootstocks, commonly called "roots." These are planted, as early in spring as the ground can be prepared, in furrows 30 inches apart. On upland two or three crops are usually grown from one setting of the "roots," but in the swamp lands the runners are plowed under after harvest, continuing the crop indefinitely. Clean cultivation is required between the rows, and often it is necessary to hoe the plants or pull weeds by hand, especially on land that has not been well prepared. Fireweed, horseweed, ragweed and other species with bitter or aromatic properties are very injurious to the oil if cut and distilled with the peppermint.

The crop is cut either with scythe or mowing machine in August or early September, when the earliest flowers are developed and before the leaves have fallen. In long, favorable seasons a second crop is sometimes harvested early in November. After cutting, the plants are cured like hay, then raked into windrows and taken to the stills, where the oil is extracted by distillation with steam. A "Mint still" (Fig. 1391) usually consists of two retorts (used alternately), wooden or galvanized iron tubs about 7 ft. deep and 6 ft. in diam. at the top, each with a perforated false bottom and a tight-fitting, removable cover, a condenser of nearly 200 ft. of block



1391. A Mint Still.

tin pipe immersed in tanks of cold water, or more frequently arranged in perpendicular tiers over which cold water runs, a boiler to furnish steam and a receiver or tin can with compartments in which the oil separates by gravity. The yield of oil varies from 10 to 60 pounds per acre, averaging about 25 pounds for Black Mint, the variety now generally grown. Three kinds of peppermint are recognized: (1) American Mint, "State Mint" of New York (*M. piperita*), long cultivated in this country and occasionally naturalized; (2) Black Mint, or Black Mitcham (*M. piperita*, var. *vulgaris*), a more productive variety introduced from England about **1889**, and (3) White Mint, or White Mitcham (*M. piperita*, var. *officinalis*), less productive and too tender for profitable cultivation, but yielding a very superior grade of oil. Peppermint oil is used in confectionery, very extensively in medicines, and for the production of menthol, or more properly pipmenthol. Pipmenthol differs in physical properties from menthol derived from Japanese Mint.

Japanese Mint, *M. arvensis*, var. *piperascens*, is cult. in northern Japan, chiefly on the island of Hondo; not known in the wild state. It has been introduced experimentally in cult. in England and the United States, but has not been cult. commercially in these countries. Its oil is inferior in quality to that of *Mentha piperita*, but it contains a higher percentage of crystallizable menthol, of which it was the original source and for the production of which it is largely used. It is propagated by rootstocks carefully transplanted and cultivated by hand-labor. Two crops, rarely three, are obtained in a season, and by abundant fertilizing and intensive culture large yields are obtained. It is usually continued three years from one planting, and then a rotation of other crops follow for from three to six years. Three horticultural varieties are recognized, being distinguished chiefly by form of leaf and color of stem. The variety known as "Akakuki," with reddish purple stem and broad, obtuse leaves, is regarded as best.

Spearmint is cultivated on peppermint farms for the production of oil. The plants are propagated and cultivated similar to peppermint and distilled in the same stills. The oil, for which there is a smaller demand than for peppermint oil, is used chiefly in medicine and to some extent as a flavoring ingredient in drinks. Spearmint is cultivated in the vicinity of many large cities to supply saloons, where freshly cut sprigs of the plant are used in making the seductive and intoxicating drink known as "Mint julep." The plant is more widely known as an ingredient in "Mint sauce," the familiar accompaniment of spring lamb and green peas. To supply this demand it is often cultivated in the kitchen-garden. It is easily propagated by the perennial root-stocks, and persists year after year with little care, thriving in nearly all kinds of soil, providing it does not become too dry.

1392. Mentha spicata—Spearmint. (×⅛.)

The Pennyroyal of the Old World is *Mentha Pulegium*.

A. *Whorls of fls. in terminal spikes or some in the upper axils.*

B. *Spikes thick: lvs. petioled.*

C. *Lvs. lanceolate, acute.*

piperita, Linn. Peppermint. Perennial, by runners and rootstocks: stems erect or ascending, 1–3 ft. high, branched, glabrous: lvs. lanceolate, acute, sharply serrate, 1–3 in. long, glabrous or pubescent on the veins beneath, punctate, with minute oil globules: fls. in thick, terminal spikes, 1–3 in. long in fruit, the central spike finally exceeded by the lateral ones; calyx glabrous below, its sharp teeth usually ciliate; corolla purple, rarely white, glabrous. Introduced in cultivation from England and occasionally naturalized in moist ground in various parts of the country. Known as "American Mint" or "State Mint," in New York.

Var. **officinàlis**, Sole. White Mint. Slender, 1–2 ft. high: lvs. 1–2 in. long: stems and foliage light-colored. Not known in wild state; long cult. in Eng. and sparingly introduced into cult. in America.

Var. **vulgàris**, Sole. Black Mint. Rather stout, 2–3 ft. high: lvs. 2–3½ in. long: stems usually purple and foliage dark-colored. Native in England. Cult. in recent years in England, Saxony and America.

CC. *Lvs. ovate or subcordate.*

citràta, Ehrh. Bergamot Mint. Perennial, by leafy stolons, glabrous throughout: stem decumbent, 1–2 ft. long, branched: lvs. thin, broadly ovate and obtuse or the uppermost lanceolate and acute: fls. in the uppermost axils and in short, dense, terminal spikes; calyx glabrous, with subulate teeth; corolla glabrous. Sparingly naturalized from Europe, in New York, New Jersey, Florida and Ohio.—The fragrant, lemon-scented oil is distilled for use in making perfumes.

BB. *Spikes slender, interrupted: lvs. sessile or nearly so.*

C. *Plant glabrous: lvs. lanceolate.*

spicàta, Linn. (*M. viridis*, Linn.). Spearmint. Fig. 1392. Perennial, by leafy stolons: stem erect, with ascending branches 1–2 ft. high: lvs. lanceolate, sharply serrate, 2½ in. or less in length: whorls of fls. in narrow, interrupted spikes 2–4 in. long, the central spike exceeding the lateral ones; calyx teeth hirsute or glabrate. Widely naturalized about old gardens throughout the older settled portions of the United States; native in Europe and Asia.

CC. *Plant pubescent: lvs. elliptic or ovate-oblong.*

rotundifòlia, Huds. Round-leaved Mint. Perennial, by leafy stolons, pubescent throughout, somewhat viscid: stems slender, erect or ascending, simple or branched, 20–30 in. high: lvs. subcordate at base, mostly obtuse, crenate-serrate, 1–2 in. long and about two-thirds as wide, reticulated beneath: fls. in dense or interrupted spikes 2–4 in. long; calyx pubescent; corolla puberulent. Naturalized in moist waste places from Maine to New Mexico.—Sometimes used as a substitute for peppermint or spearmint.

AA. *Whorls of fls. all axillary.*

B. *Plants usually decumbent: fls. nearly sessile.*

Canadénsis, Linn. American Wild Mint. Perennial, by runners and rootstocks: stem usually pubescent, with spreading hairs, erect or ascending, simple or branched, 6–30 in. high: lvs. ovate-oblong or lanceolate, glabrous or nearly so, 2–3 in. long, slender-petioled, the petioles often exceeding the nearly sessile whorls of light purple fls.: calyx pubescent. In wet soil or in water at the margins of streams, New Brunswick to British Columbia and southward to Virginia and New Mexico. It is a common plant.—Often called peppermint, for which it is frequently mistaken and for which it is sometimes used as a substitute. It is variable in habit and also in the character of its oil.

BB. *Plants somewhat rigidly erect: fls. distinctly pedicelled.*

arvénsis, var. **piperáscens**, Malinvaud. Japanese Mint. Perennial, by running rootstocks, puberulent or finely pubescent throughout: stems erect, with numerous branches, 2–3 ft. high: lvs. lanceolate and acute to broadly oblong and obtuse, narrowed at the base, 1½–3½ in. long, sharply serrate, with low teeth: fls. in rather loose, axillary whorls, in distinctly pedicellate umbels, usually shorter than the slender petioles; calyx pubescent, its subulate teeth about half as long as the tube; corolla puberulent. Lyster H. Dewey.

MENTZÈLIA (Mentzel, an early German botanist). *Loasàceæ.* About 50 species of erect, sometimes woody herbs, 1-5 ft. high, many natives of North America. Lvs. alternate, mostly coarsely toothed or pinnatifid: fls. solitary or in cymes, white, yellowish, yellow or red; petals 5 or 10, regularly spreading, convolute in the bud, deciduous; stamens indefinite, rarely few, inserted with the petals on the throat of the calyx: seeds flat. They thrive in sunny, moist or dry situations sheltered from strong winds. *M. Lindleyi*, from Calif., is common in eastern gardens, where it is known as *Bartonia aurea;* the other species are offered by western dealers, but are not generally in cult. They flower in summer. Although *M. Lindleyi* has long been a rather common plant in cultivation, it is little known in the wild, being probably a native of central Calif. The seeds should be sown where the plants are to remain, as they do not bear transplanting.

A. *Color of fls. yellow.*

B. *Fls. opening in bright sunshine.*

C. *Petals 1 in. long.*

Lindleyi, Torr. & Gray (*Bartònia aùrea*, Lindl.). Fig. 1393. Annual: stem 1-3 ft. high, branched and straggling: lvs. 2-3 in. long: fls. about 2½ in. across, bright yellow, very fragrant in the evening, bracted; petals 5, broadly obovate, nearly as broad as long, rounded at the apex except an abrupt short point. Probably central Calif. B.M. 3649. B.R. 22:1831.

CC. *Petals 2-2½ in. long.*

lævicaùlis, Torr. & Gray. Biennial: stem 2-3 ft. high: lvs. 2-8 in. long: fls. yellow, 2½-3 in. across, bractless; petals lanceolate, acuminate. Neb. to Calif. B.B. 2:459.

BB. *Fls. opening towards night.*

nùda, Torr. & Gray. Biennial: stem somewhat slender, 1-5 ft. high: lvs. 1-3 in. long: fls. creamy white, 1½-2½ in. across, usually bractless; petals 10. Dakota to Kans., Colo. and Tex. B.M. 5483 (as *Bartonia nuda*). B.B. 2:458.

AA. *Color of fls. pure white.*

ornàta, Torr. & Gray. Annual: stem 2 ft. and more: lvs. 2-6 in. long: fls. 5 in. across, opening towards night, fragrant, usually bracted; petals 10; stamens 200-300. Dakota and Mont. to Tex. R.H. 1878:430. B.M. 1487 (as *Bartonia decapetala*). B.B. 2:459.

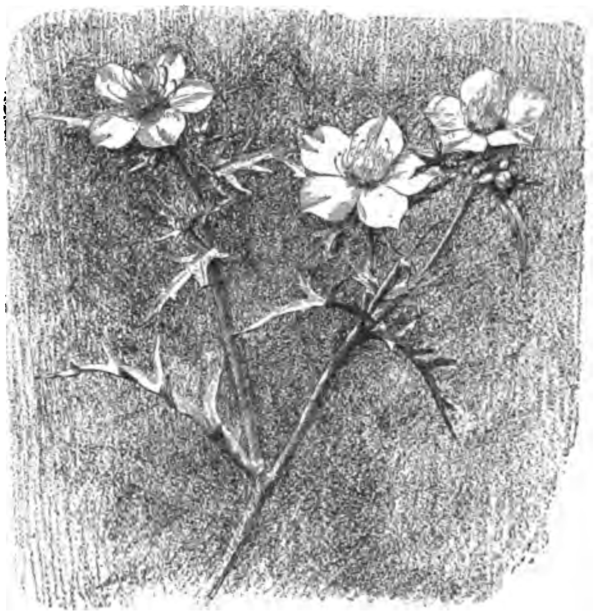
M. B. COULSTON and W. M.

MENYÁNTHES (Greek, *men*, a month, and *anthos*, flower; perhaps because it flowers for about a month). *Gentianàceæ.* BUCKBEAN. A genus of 2 species of small perennial bog plants with creeping rootstocks and small, 5-lobed white or purplish fls. borne in late spring. They are procurable from dealers in native plants. The genus is one of the few aquatic groups in the gentian family. It is allied to Limnanthemum, but the fls. of the latter are not bearded or crested on the face as they are in Menyanthes. Lvs. all alternate, stalked: corolla somewhat funnel- or bell-shaped; stamens inserted on the tube of the corolla; hypogynous glands 5: style long.

trifoliàta, Linn. BUCKBEAN. About 9-18 in. high: lfts. 3, oval or oblong-obovate, 1-1½ in. long: raceme about 12-fld. Bogs, north temperate regions. B.B. 2:622. V. 2:198 and 3:208.—The lvs. are said to be used in Germany as a substitute for hops in beer-making. A very interesting bog plant.

MERCURY. *Chenopodium Bonus-Henricus.*

MERENDÈRA (from *quita meriendas*, Spanish name of *Colchicum autumnale;* some of these plants formerly considered to belong to Colchicum). *Liliàceæ.* About 10 species of bulbous plants, mostly natives of the Mediterranean region and Asia Minor. They belong to the same tribe with Colchicum and Bulbocodium, but Colchicum has a real corolla tube, while the other two genera have 6 very long-clawed segments which are merely connivent, forming a loose tube at first and afterwards separating. In Merendera there are 3 styles which are distinct from the base, while in Bulbocodium the style is 3-cut only at the apex. Merenderas are low, stemless plants with tunicated corms: lvs. linear, appearing with the fls.: fls. 1-3, appearing in spring or fall, mostly lilac-colored. The genus is divided by Baker (Jour. Linn. Soc. 17:438, 1880) into two groups, based on the anthers. The 2 species described below belong to the group with small, oblong, versatile anthers, which are fastened at the middle rather than the base. They are hardy spring-blooming plants with about 3 lvs., and fls. 1-1½ in. across. These rare plants are procurable from Dutch bulb-growers. They are pretty, small-fld., early-blooming, hardy, fragile plants which persist well under good garden cultivation.



1393. Mentzelia Lindleyi (×½).

A. *Blade of petals oblanceolate, obtuse.*

Caucásica, Bieb. The 3 outer corolla segments appendaged on each side at the junction of blade and claw; new corms sessile. Caucasus, Persia. B.M. 3690.

AA. *Blade of petals lanceolate, acute.*

sobolìfera, Fisch. & Mey. Segments not appendaged: a very small new corm produced at the apex of a shoot. Asia Minor, Persia.

M. Ruthénica is advertised by Van Tubergen.

J. N. GERARD and W. M.

MERTÉNSIA (after Mertens, a German botanist). *Borraginàceæ.* About 15 species of perennial herbs, natives of the north temperate zone, the most popular of which is *M. pulmonarioides*, better known as *M. Virginica*, Virginia Cowslip, Blue Bells, and Virginia Lungwort. This grows 1-2 ft. high and bears more or less drooping clusters of blue-belled fls. in March to May (see Fig. 1394). The fls. are about 1 in. long, and 20 or more in a terminal group. They have a purple tube and blue bell of distinct shape, the lobes of the corolla being less pronounced than in the other species. Mertensias are allied to Pulmonaria, but the fls. have no bracts, as in Pulmonaria. They are botanically nearer Myosotis, which contains the forget-me-nots. Mertensias are glabrous or pilose: lvs. alternate, often having pellucid dots: racemes terminal or the cymes loose, few-fld., 1-sided, sometimes panicled: fls. blue or purplish, rarely white; calyx 5-cut or 5-parted; lobes 5; stamens fastened at the middle of the tube or higher.

The common Mertensia is one of the plants that should remain undisturbed for years, and hence is suited to the rockery. Its leaves die down soon after flowering time. The plant should have a sheltered position, full sunshine and rich, loamy soil. *M. Sibirica* is considered by some even more desirable. The fls. are later, light blue, and not as distinctive in form. The foliage of *M. Sibirica* lasts through the summer. Mertensias may be prop. by seed if sown as soon as ripe, but with uncertainty by division. Although of secondary importance, Mertensias add variety to the border and are nearly always attractive to plant-lovers.

1394. Virginian Cowslip or Blue Bells —Mertensia pulmonarioides (X ⅓).

A. *Fls. trumpet-shaped, the open portion not prominently 5-lobed; filaments much longer than the anthers.*

pulmonarioides, Roth. (*M. Virgínica,* DC.). VIRGINIAN COWSLIP. BLUE BELLS. Fig. 1394. Very smooth and glabrous: lvs. obovate or oblong, or the lowest large, rounded and long-stalked; veins conspicuous: fls. generally more nodding than shown in Fig. 1395. Spring. N. Y. to S. C. and Tenn., usually inhabiting low or moist grounds. B.M. 160 (as Pulmonaria). B.B. 3:60. Gn. 23, p. 463, and 32, p. 173. V. 3:181; 7:244; 11:180, and 12:140. Mn 4:33.

AA. *Fls. with the upper portion more bell-shaped and prominent spreading lobes: filaments shorter than the anthers or only a little longer.*

B. *Tube of corolla 2 or 3 times as long as the bell.*

oblongifòlia, G. Don. About 9 in. high, smooth: lvs. mostly oblong or spatulate-lanceolate; veins inconspicuous: calyx lobes acute. Western N. Amer.—Not easy to cultivate.

BB. *Tube of corolla not twice as long as the bell.*

C. *Calyx-lobes obtuse, oblong.*

Sibírica, G. Don. This and the next grow 1-5 ft. high and have broad, veiny lvs., the upper ones very acute or acuminate. *M. Sibirica* is pale, smooth and somewhat glaucous: stem-lvs. oblong- or lanceolate-ovate. E. Siberia, Rockies and Sierras. Gn. 18:259.—Offered by some American dealers.

CC. *Calyx-lobes acute, lanceolate or linear.*

paniculàta, G. Don. Greener than *M. Sibirica,* roughish and more or less pubescent: stem-lvs. ovate to oblong-lanceolate. Lake Superior and north, E. Asia. B.B. 3:60. B.M. 2680 and B.R. 2:146 (as *Pulmonaria paniculata*).

M. umbrátilis, Greenm., from Oregon, a recently described species, is offered by Horsford. Allied to *M. Sibirica,* but has larger corolla and longer lanceolate-acute calyx-lobes.

G. C. WOOLSON and W. M.

MESCAL BUTTON is *Echinocactus Williamsii.*

MESEMBRYÁNTHEMUM (Greek, *midday flower;* the flowers usually open in sunshine and close in shadow). *Ficóideæ,* or *Mesembryàceæ.* FIG MARIGOLD. The type genus of a family of something more than 20 genera and about 500 species, widely distributed in dry tropical and subtropical regions. Of the other genera known to horticulturists, only Tetragonia and Sesuvium are prominent, and even these are relatively unimportant. Mesembryanthemum itself includes some 300 species, nearly all of which are South African, according to Sonder "abounding throughout the arid plains and sands of the whole country to the south of the Orange river and west of the Great Fish river." Four species are described by Bentham in Flora Australiensis. Two (*M. crystallinum* and *æquilaterale*) are native in California. Others occur in New Zealand, Canaries, Arabia and the Mediterranean region. They are succulent plants, mostly herbs, but some are shrubs. They are allied botanically to the cactaceous series, although lacking the spines of those plants and bearing true leaves. Horticulturally, they are fanciers' plants, and are classed with "succulents." Very few are in the general trade, although a number are advertised in California and others are in botanic gardens. Usually the flowers open only in bright sunlight, but there are a few evening-blooming species. As with most succulents, the species are not well understood botanically, owing largely to the difficulty in making herbarium specimens. Many of them are of odd and grotesque form. One species, *M. crystallinum,* is a common house plant, being known as Ice Plant, but it is one of the least showy in flower. It is grown for the thick glistening foliage. It propagates readily by seed or division. The best available account of the Mesembryanthemums is Sonder's elaboration of the S. African can species (293 numbers) in Flora Capensis, Vol. II (1861-2)

L. H. B.

In Mesembryanthemum the leaves are mostly opposite, entire or the margin somewhat spiny, fleshy and often subcylindrical or triangular in cross-outline; flowers perfect and regular, axillary and solitary or somewhat corymbose; calyx gamosepalous, usually with 5 unequal lobes and the tube adnate to the ovary; petals very many, in one or more rows, usually linear, white, yellow or rose-color; stamens very numerous: ovary most commonly 5-loculed: fruit or capsule opening radially at the summit, hygroscopic: seeds very numerous, small. "The capsules are tightly closed in dry weather and open naturally after a rain," writes Sonder. "If thrown in water until it becomes thoroughly soaked and then removed, an old capsule will open out its capillary valves, radiating from a center like a star; and will close them again when dry. This experiment may be repeated several times without destroying their remarkable hygrometric property." The following species are S. African unless otherwise noted. Mostly perennials.

Mesembryanthemum, or Fig Marigold, is a large genus, and the majority of the species are natives of the Cape of Good Hope. They are found in their native habitats growing most luxuriantly on dry, barren, rocky places and on dry, sandy plains. They are succulent plants with thick, fleshy leaves, and are therefore able to stand the severe drought they have to put up with in those arid places. Knowing that these plants delight in dry, arid situations, this gives the key to their cultivation. When grown in pots, care should be taken that the pots are well drained. A light, sandy loam, mixed with brick rubbish broken small, makes a good compost for them. In summer they can be placed out-of-doors in a slightly elevated and sunny position, where they will produce an abundance of their showy blossoms. On the approach of cold weather in the fall they may be placed in a cool greenhouse with a dry atmosphere and plenty of air. Very little water is needed during the dull months of winter. Some of the species make good window plants. *M. cordifolium,* var. *variegatum* is largely grown for edgings for beds. *M. pomeridianum* and *M. tricolorum* are good showy annuals. Propagation is effected either by cuttings or by seeds. Cuttings should be dried in the sun for two or three days before they are inserted in sand.

ROBERT CAMERON.

INDEX.

acinaciforme, 10.
acutangulum, 22.
æquilaterale, 12.
albinatum, 3.
angustum, 4.
aurantiacum, 14.
aureum, 15.
barbatum, 31.
blandum, 18.
cordifolium, 27.
crystallinum, 24.
cultratum, 6.
densum, 33.
depressum, 7.
edule, 13.
elegans, 28.
felinum, 2.
floribundum, 30.
geminatum, 21.
glabrum, 26.
inclaudens, 17.
linguæforme, 5.
mutabile, 16.
muricatum, 20.
pomeridianum, 25.
pustulatum, 8.
rubrocinctum, 11.
spectabile, 19.
stellatum, 32.
stipulaceum, 23.
subcompressum, 29.
tigrinum, 1.
tricolor, 9.
tricolorum, 9.
variegatum, 27.

A. EPAPULOSA: *Plant not bearing glittering papillæ or projections* (species 1–23).

B. *Plant stemless or nearly so.*

C. *Lvs. 4–6, semi-terete at the base, thickening and triquetrous at the apex.*

1. **tigrinum**, Haw. TIGER'S JAW. Stemless or essentially so: lvs. cordate-ovate, 2 in. or less long, glaucous green and marbled with white, the upturning edges with long, soft, ciliated teeth, the keel entire: fls. nearly sessile, large, yellow. B.R. 3:260.

2. **felinum**, Haw. Fig. 1395. Lvs. triquetrous, rhomboid-lanceolate, 2 in. or less long, but narrower than in the last, somewhat glaucous, faintly dotted with white, the edges with 8 ciliate teeth; keel entire: fls. nearly sessile, yellow.

CC. *Lvs. 4–6, triquetrous, thickened from the base to the middle, but tapering to the apex.*

3. **albinàtum**, Haw. Stemless: lvs. curved-triquetrous upwards, with a recurved mucro or spine at the apex, bearing elevated whitish dots: fls. sessile, yellow.

CCC. *Lvs. half-cylindrical, of various sizes or forms on the same plant, in alternate pairs.*

4. **angústum**, Haw. Nearly or quite stemless, small: lvs. 2-ranked, linear, tongue-shaped, long, keeled at the apex, somewhat unequal, one of them straight-acute and the other hooked: fls. nearly sessile, yellow.

CCCC. *Lvs. tongue-shaped, with one margin thicker than the other, of two or more forms, 2-ranked.*

D. *Peduncle less than 1 in. long.*

5. **linguæfórme**, Haw. Lvs. unequally tongue-shaped, deflexed and somewhat falcate, becoming depressed when old, flattish above. obliquely attenuate: fls. yellow. Index Kewensis makes the *M. linguæforme* of Haworth synonymous with *M. obliquum*, Willd., and uses Linnæus' *M. linguiforme* as a tenable name.

DD. *Peduncle 1 in. or more long.*

6. **cultràtum**, Salm-Dyck. Lvs. 2-ranked, thick, tongue-shaped and curved like a pruning-knife, blunt at the apex: fls. yellow, on a somewhat 3-angled peduncle.

7. **depréssum**, Haw. Prostrate: lvs. narrow, tongue-shaped, recurved-depressed, acute: fls. yellow, with petals somewhat recurved.

8. **pustulàtum**, Haw. Lvs. 2-ranked, narrow, tongue-shaped, long and ascending, blunt, bearing pustules near the base: fls. yellow.

BB. *Plant with an evident erect or prostrate stem.*

C. *Foliage lvs. distinct or essentially so (not truly perfoliate nor connate).*

D. *Stem or caudex prostrate.*

E. *Peduncle with 2 bracts.*

9. **tricolòrum**, Haw. (*M. tricolor*, Hort.). Stem 1 ft. long: lvs. cylindrical, acute, green, 2–3 in. long, minutely punctate: fls. yellow, blood-colored inside, the petals acute, the anthers brown. Gn. 24, p. 89.—There is a white-fld. form.

10. **acinacifórme**, Linn. Stem articulate, 2–3 ft. long, the young growth compressed: lvs. opposite, 2–3 in. long, simitar-shaped (curved and thicker on one edge), the keel dilated: fls. purple, about 4 in. across, "the largest in the genus," the stigmas 14: fr. size of a gooseberry, and eaten by Hottentots.—Handsome.

11. **rubrocinctum**, Haw., is probably a form of the last, differing in having a red line on the keels of the lvs. B.R. 20:1732.

12. **æquilateràle**, Haw. Differs from *M. acinaciforme* chiefly in thinner lvs. and smaller fls.: fls.. fragrant, 1½ in. across. Native to Australia, Tasmania, Chile and S. Calif.

EE. *Peduncle without bracts.*

13. **édule**, Linn. Stem angular: lvs. opposite, 3–4 in. long, triquetrous. curved, the keel serrate: fls. large, yellow or purple, the stamens 8: fr. edible, being one of the Hottentot Figs. Grows well on the sea cliffs in S. England, making long, hanging masses (Gn. 55, p. 235, with picture).

DD. *Stem, or at least the branches, erect or prominently ascending.*

E. *Fls. yellow, orange or copper-color.*

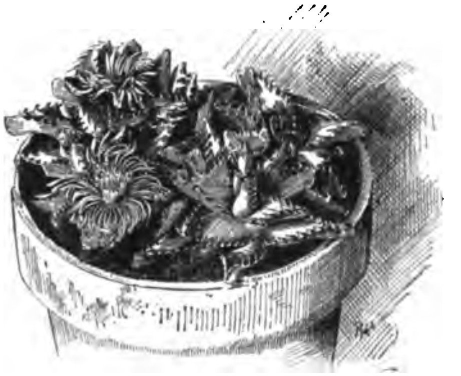
14. **aurantiacum**, Haw. Stem becoming 1 ft. or more high, much branched, sometimes decumbent at base, the branches somewhat compressed: lvs. 1 in. or less long, smooth and glaucous, bluntly triquetrous: fls. orange, with petals ¾ in. long and in about 3 series.

15. **aùreum**, Linn. Larger: lvs. 1½–2 in. long, cylindrically triquetrous, smooth and glaucous, mucronate: fls. golden, 2 in. across, the petals in many series. B.M. 262.—In this and the last, the lower lvs. are often nearly connate at the base.

EE. *Fls. rose-color or purplish.*

F. *Petals of two unlike kinds,—subulate and linear-lanceolate.*

16. **mutábile**, Haw. With straw-color or reddish tortuous, erect branches: lvs. about ½ in. long, compressed-triquetrous, incurved, the keel entire, apex acute: fls. mostly solitary on an upwardly thickened peduncle, rose-color, the inner short petals pale yellow.



1395. Mesembryanthemum felinum (×⅓).

17. **inclaúdens**, Haw. Distinguished from the last by scimitar-shaped lvs. and broader petals: lvs. crowded, green, compressed-triquetrous and scimitar-shaped (thicker on one edge).

FF. *Petals of one kind.*

18. **blándum**, Haw. Two ft., with numerous branches: lvs. distant, 2 in. or less long, compressed-triquetrous, but with equal sides, narrow, minutely dotted, acutish: fls. 2 in. across, pale rose, the petals toothed. B.R. 7:582. L.B.C. 6:599.

19. **spectábile**, Haw. Stem prostrate, but branches ascending: lvs. 2–3 in. long, crowded, glaucous, incurved and spreading, triquetrous, attenuate and mucronate: fls. purplish; petals 1 in. long, the inner somewhat shorter. B.M. 396.

20. **muricàtum**, Haw. Stem suberect: plant bluish: lvs. less than ½ in. long, somewhat incurved, deltoid and toothed, very glaucous: fls. small and fragrant, the petals acute.

CC. *Foliage lvs. truly connate or perfoliate.*

D. *Lvs. triquetrous.*

21. **geminàtum**, Haw. Dwarf: stem subshrubby, the branches procumbent: lvs. erect, glaucous white, the cartilaginous margins entire: fls. white (?).

22. **acutángulum**, Haw. Stem shrubby, with rigid and erect branches: lvs. sheathing, ½ in. long and about as long as the internodes, glaucous green, triquetrous, compressed near the apex, somewhat incurved: fls. white, small, in a panicle.

DD. *Lvs. elongated, subulate or somewhat cylindrical.*

23. **stipulàceum**, Linn. Dwarf, with erect, decussate branches: lvs. 1½–2 in. long, very slender, crowded, spreading and recurved, very glaucous: fls. in the axils, mostly solitary, purplish.

AA. PAPULOSA: *Plant usually bearing glittering papillæ, vesicles or projections on stems and lvs.,—hence the popular name Ice Plant* (species 24–33).

B. *Root annual or biennial (cult. as annuals).*

C. *Fls. white or rose-color, sessile or nearly so.*

24. **crystallinum,** Linn. ICE PLANT. Fig. 1396. A common plant in window-gardens and hanging baskets, and readily grown from seeds (which are offered by seedsmen), procumbent: lvs. flat, fleshy, ovate or long-spatulate, usually clasping, undulate, covered with glistening dots or elevations: fls. small, whitish or varying to light rose-color. S. Afr., Greece, Canary Islands, S. Calif.—Grown for its glistening foliage. Fls. open in the sun.

1396. Common Ice-plant—Mesembryanthemum crystallinum. (×⅓.)

CC. *Fls. yellow, long-peduncled.*

25. **pomeridiànum,** Linn. Stem simple or forking, the branches ascending, hairy on branches, peduncles and calices: lvs. lance-spatulate or spatulate, narrowed into a petiole, ciliate: 2 of the calyx lobes longer than the petals; petals linear-lanceolate.

26. **glàbrum,** Ait. Glabrous: lvs. lance-spatulate, petiolate and dilated at base: fls. straw-colored, darker at the eye; lobes of the calyx linear and unequal.

BB. *Root perennial and the stem becoming somewhat woody.*

C. *Lvs. flat, petiolate.*

27. **cordifòlium,** Linn. Stems 1–2 ft., diffuse, minutely papillose: lvs. opposite, 1 in. or less long and nearly as wide, cordate-ovate, somewhat papillose: fls. solitary, peduncled, purple, the petals short and linear. A var. **variegàtum** is in cult., and is a good half-hardy trailing plant.

CC. *Lvs. compressed-triquetrous, not petiolate.*

28. **élegans,** Jacq. Shrubby, 6–12 in. or more tall, branchy, whitish or red: lvs. crowded, ½ in. long and very narrow, very glaucous, scabrous: fls. numerous, mostly panicled, pale red (or whitish), the petals ½ in. long.

CCC. *Lvs. terete or nearly so.*

D. *Branches hispid or bristly.*

29. **subcompréssum,** Haw. Erect, 2 ft.: lvs. not crowded, ¾ in. or less long, narrow, very blunt, greenish canescent, flattened-terete: fls. solitary, purplish; calyx lobes unequal.

30. **floribúndum,** Haw. Tortuous in growth, the branches not over 6 in. long, more or less decumbent: lvs. less than 1 in. long, very narrow, terete, curved, obtuse, a little thicker towards the apex: fls. small, axillary, rose-color, the 5 styles exserted, the petals twice longer than the calyx.

DD. *Branches not hispid.*

31. **barbàtum,** Linn. A foot or more tall, diffuse and decumbent: lvs. not crowded, ½ in. long, spreading, green and pellucid, semi-cylindrical, with 5 or 6 hairs at the end: fls. solitary, reddish, the petals entire and 2–3 times longer than the calyx.

32. **stellàtum,** Mill. Three or 4 in. high, fleshy and tufted: lvs. crowded, ½ in. long, glaucous, semi-cylindrical, scabrous, with many hairs at the apex: peduncles hairy: fls. reddish violet, the calyx campanulate, ¼ in. long.

33. **dénsum,** Haw. Much like the last: lvs. longer, flattish above and convex beneath, ciliate also at the base: calyx longer: fls. reddish violet. R.H. 1869, p. 356.

Accessible pictures of Mesembryanthemums which are not mentioned in American lists, are as follows: *M. Bolùsii*, Hook. f. B. M. 6664.—*M. Brównii*, Hook. f. B. M. 6965.—*M. criniflòrum*, Linn. R. H. 1857, p. 122 (as M. cuneifolium).—*M. ficifórme*, Haw. G. C. II. 25:373.—*M. minutum*, Haw. R. H. 1869, p. 356.—*M. pugionifórme*, Linn. R. H. 1857, p. 178.—*M. ròseum*, Willd. Gn. 52, p. 439.—*M. testiculàtum*, Jacq. R. H. 1869, p. 35 (as M. octophyllum).
L. H. B.

MESOSPINÍDIUM (Greek compound; meaning obscure). *Orchidàceæ.* The plants cultivated as Mesospinidium are referred by some to the genus Cochlioda. They have the habit of a slender Odontoglossum, with sheathing lvs. at the base of the pseudobulbs. Fls. in racemes or panicles; sepals and petals sub-similar, expanded; labellum with 2 longitudinal ridges, adnate to the column, with rounded lateral lobes and a narrow middle lobe: column long or short: pollinia 2, seated on a rhomboid pedicel. These plants are evergreen coolhouse orchids, and thrive well in baskets of peat and moss, with plenty of water. Cochlioda has about 5 species, of which the following is often cultivated:

sanguíneum, Reichb. f. Pseudobulbs oval, 2-lvd., mottled: lvs. ligulate, sharp-pointed, shorter than the many-fld. drooping panicle: fls. numerous, small, vivid rose; the lower sepals are partially united, oblong: petals cuneate-ovate. Peruvian Andes. B.M. 5627.

M. vulcánicum, Reichb. f., is described as Cochlioda vulcanica (p. 341), its proper name.
HEINRICH HASSELBRING.

MÉSPILUS (Greek, substantive name). *Rosàceæ.* MESPIL. MEDLAR. From Pyrus, with which this genus is united by British authors, Mespilus differs in bearing the flowers singly on leafy growths of the season (the fruits, like the quince, having no true detachable peduncles as pears and apples do), and in having the top of the ovaries not covered by the over-growing receptacle. There is but one species of true Mespilus, but some authors (e. g., Focke, in Engler & Prantl's "Die Natürlichen Pflanzenfamilien") include some of the Cratægus species in the genus.

The common Medlar is **Méspilus Germánica,** Linn., native to Central Europe. To a considerable extent in parts of Europe it is grown for its acid fruits, but in this country it is very little known. It is perfectly hardy in central New York, and its cultivation requires no special treatment or skill. It makes a twiggy, tough-wooded bush or small tree, 10 to 15 feet high, bearing large white blossoms late in May or early in June, after the leaves are full size. The foliage is soft and luxuriant; leaves lance-oblong or long-oblong, pubescent, simple, serrate. The fruit (Fig. 1397) remains hard and austere until mellowed by frosts. With the freezing and the incipient decay, the fruit becomes brown and soft. It is usually picked after it is touched by frost and laid away on shelves or in drawers in a cool, dry room; the ripening process which follows is known as bletting. When finally softened, it is agreeable for eating from the hand, particularly for those who enjoy fruit-acids. It also makes good preserves.

1397. Medlar—Mespilus Germanica. Natural size.

Medlars are easily raised from seeds, although seeds (like those of Cratægus) may not germinate the first year. On these stocks the named varieties may be grafted or budded. Medlars may also be worked on pear, thorn (Cratægus) or quince. The Dutch or Hollandish and the Nottingham are the leading varieties. The fruit of the former is often 2¼ inches in diameter. The latter is much smaller, but is better in quality. There is also a seedless variety.

M. grandiflòra, Smith (M. Smithii, DC.). is Cratægus grandiflora (see p. 397). Gn. 22, p. 163 and 34, p. 66. L. H. B.

MESQUIT of Mexico is *Prosopis juliflora* (Leguminosæ). A picture of a Mesquit forest is shown in G. F. 1:116.

METROSIDÈROS (Greek, *heart of iron;* this and other genera of the Myrtle family are called ironwoods). *Myrtàceæ*. About 18 species of trees and shrubs, rarely climbers, mostly natives of the Pacific islands from New Zealand to Hawaii. They belong to the class of Australasian shrubs whose chief beauty lies in their long red anthers. They are somewhat grown for a fancy Easter trade by florists, largely from imported stock. In Metrosideros the flowers are borne in dense 2- or 3-forked cymes, while in Callistemon they are borne in spikes. Leaves mostly opposite: petals 5, spreading; stamens 1 inch or more long, much longer than the petals. The species described below are coolhouse shrubs, and are rarely grown outdoors in the South.

Apparently the commonest of the Bottle Brushes in the trade is *Callistemon lanceolatus*, which is passing among florists as *Metrosideros floribunda* and *M. robusta*. In Fig. 320 (page 218) the plant is shown with apparently terminal inflorescence, but the branch is really terminated by some leaf buds, which develop later, as in Fig. 1398. The handsome plant figured in William Scott's "Florists' Manual," and to which he refers in the following paragraph as *Metrosideros robusta*, seems to be none other than *Callistemon lanceolatus* (see supplementary list). W. M.

The plant known to the trade as *Metrosideros robusta* has been grown for many years as a cool greenhouse plant, but it is only within a dozen years that Europeans have been sending American florists the compact little bushes that now arrive with our Azaleas. The city florist can perhaps dispose of one of these Bottle Brushes for every ten plants of *Azalea Indica*. Plants in 6-inch pots, well flowered, fixed with a red ribbon and placed in a modern basket certainly look novel and attractive. The Belgians grow the young plants in peat, as they do most hardwooded plants, but they do very well in good turfy loam with a fourth of leaf-mold. Cuttings of the young growth may be struck in early spring and planted out in good soil by the end of May, but it is cheaper to import stock. When the plants arrive soak the ball of roots, pot firmly and place them in a house of about 45°. Freshly imported plants cannot be forced in much heat, like Azaleas, or they will shed their flowers. Watch them carefully, give them more heat gradually and they will bloom for Easter.

Plants unsold the first spring will be much more satisfactory the second year. By the end of April cut them back to within 1 or 2 inches of the old growth, put them in a good heat and keep them syringed. They will make a bushy growth, with a good number of shoots. Early in June plunge them in a sunny spot outdoors, with the rim of the pot well covered, and be careful that they do not suffer for water in hot weather. In July, or earlier, mulch the pots with an inch of half-decomposed cow manure. Before frost remove the plants to a temp. of 45°, or warmer if bloom is desired before Easter.

WILLIAM SCOTT.

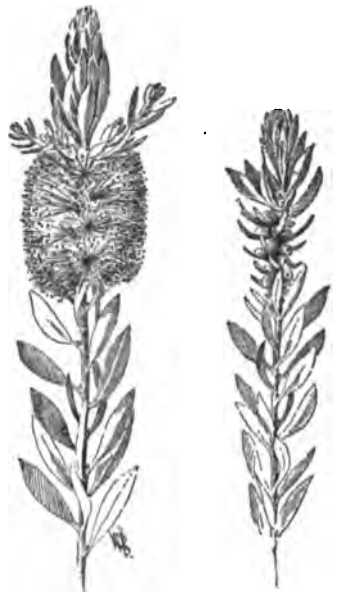
A. *Flowers red.*

robústa, A. Cunn. Lvs. opposite, elliptic-ovate, obtuse, veiny, with an extra nerve near each margin and parallel, glabrous: inflorescence a 3-forked cyme: fls. red; calyx top-shaped. New Zeal. B. M. 4471 (erroneously as *M. florida*).

AA. *Flowers yellowish.*

flórida, Sm. Lvs. opposite, obovate-oblong, veiny, glabrous: inflorescence a thyrse: fls. yellowish; calyx top-shaped, minutely silky. New Zeal. Not B.M. 4471, which is *M. robusta*.—The typical form is not advertised, but only var. **variegàta.**

M. floribúnda is not advertised in America, but stock imported by an Ithaca florist under this name from Belgium is Callistemon lanceolatus (Fig. 1398). M. floribunda, Smith, is thought to have white fls. Lvs. opposite, petiolate, ovate-lanceolate: fls. in an umbel-like, decussately branched panicle. Australia.—*M. sempérflorens*, Lodd.—Callistemon lanceolatus.—*M. speciòsa*, Sims—Callistemon speciosus. W.M.



1398. Metrosideros floribunda of the trade, but Callistemon lanceolatus of the botanists.

MEXICAN TEA. Consult *Chenopodium.*

MEYÈNIA. See *Thunbergia.*

MEZEREUM. See *Daphne Mezereum.*

MICHAÙXIA (André Michaux, 1746–1802, French botanist, who lived for ten years in America and wrote much on American plants). *Campanulàceæ*. About 4 species of rather coarse-habited biennial herbs from the Orient, of which *M. campanuloides* is best known. It grows 4–5 ft. high, has irregularly toothed, bristly-hairy foliage and large, curious drooping fls., white, tinged with purple, wheel-shaped at first, later reflexed. The flower is parted nearly to the base into 8–10 oblong segments, 1½–2 in. long. This plant is a striking subject for the back of a hardy border. It is easily prop. by seeds (which should be fresh), and likes a well-enriched soil of a light nature. An American dealer offers a climber with bell-shaped fls. under the name of *M. campanulata* but these plants are erect herbs.

Michauxia belongs, with Campanula and other genera of garden importance, to a group characterized by having the capsule closed at the top and opening laterally by little holes between the ribs or by small solitary valves. Michauxia is distinguished from the other genera of this group by the 8–10-parted corolla with narrow, spreading, finally reflexed lobes and an 8–10-celled ovary. Michauxias are erect plants, hispid or glabrous: lvs. irregularly toothed or lobed, the stem-lvs. few: fls. terminal or strung along the branches, the top ones opening first, peduncled or nearly sessile, white or pale rose.

campanulòides, L'Hér. Lvs. lanceolate in outline; upper ones sessile, acute, almost clasping: calyx with reflexed appendages shorter than the lobes; stamens 8. Asia Minor. B.M. 219. J. B. KELLER and W. M.

MICHÈLIA (P. A. Micheli, 1679–1737, Italian botanist). *Magnoliàceæ.* Twelve to 17 species of temperate and tropical trees, mostly natives of mts. of India, 2 of which are cult. in our southern states for their handsome magnolia-like foliage and red or pale yellow, fragrant fls. Fls. mostly axillary, solitary; sepals and petals similar, 9–15 or more, in 3 or more series; stamens as in Magnolia; carpels in a loose spike; stigma decurvent: ovules 2 or more: fr. a long, loose or crowded spike of leathery carpels, which split down the back: seeds like Magnolia.

A. *Fls. pale yellow.*

Champàca, Linn. A tall tree native of the Himalayas: lvs. ovate-lanceolate, tapering to a long point, 8–10 in. long, 2½–4 in. broad, shining above, pale and glabrous or puberulous beneath; petiole 1½ in. long: fls. 2 in. across; sepals oblong, acute; petals linear: fr. 3–4 in. long.

AA. *Flowers red.*

fuscàta, Blume. Lvs. elliptic-lanceolate: none of the sepals or petals linear. China. B.M. 1008 (*Magnolia fuscata*).

M. B. COULSTON.

Michelia fuscata is one of the most popular garden shrubs in the southern states. It is known as the Brown-flowered or Banana shrub; also *Magnolia fuscata.* It is shrubby in habit, attains a height of 10 to 15 ft. and is perfectly hardy in the middle and lower South. The shining young twigs and petioles are covered with brown tomentum. The fls. are 1–1½ in. across, brownish yellow, edged with light carmine, exhaling a strong banana fragrance. The flowering period extends from the end of April until June. Prop. by seeds as stated for *Magnolia grandiflora*, but as seed is somewhat scarce, the better method is from ripened wood cuttings, under glass and with bottom heat. The cuttings should have 1 or 2 lvs. left, and be cut before very cold weather. It is a very desirable conservatory shrub in northern sections.

P. J. BERCKMANS.

MICHIGAN HORTICULTURE. Fig. 1399. The location of the lower peninsula of Michigan is a most fortunate one for the pursuit of horticulture. Flanked on either side by a great body of water, the climate is modified materially both summer and winter, thus affecting the kind and quality of products that can be successfully grown. Peaches are regularly ripened on a parallel that forms the northern boundary of Vermont; even figs have been ripened in the open air in the southwestern corner of the state. This modification of climate affects not only temperature, but humidity; and on the side of prevailing winds during the heated season there is greater immunity from drought as a result of the moisture-laden atmosphere.

Michigan is covered with drift, and the soil in the western portion is, in considerable measure, open and porous in character, but having as a constituent properties admirably suited to the growth of trees. The kind of timber growing naturally upon the soil of western Michigan has deceived many people with regard to the character of the soil. Elsewhere heavy timber has usually grown on clay loam, but some of our light, sandy soils were covered originally by a heavy growth of beech, maple and basswood. This peculiar adaptation of western Michigan to the growth of timber trees has been a strong factor in favor of orcharding, and some of the finest orchards are upon the lighter lands.

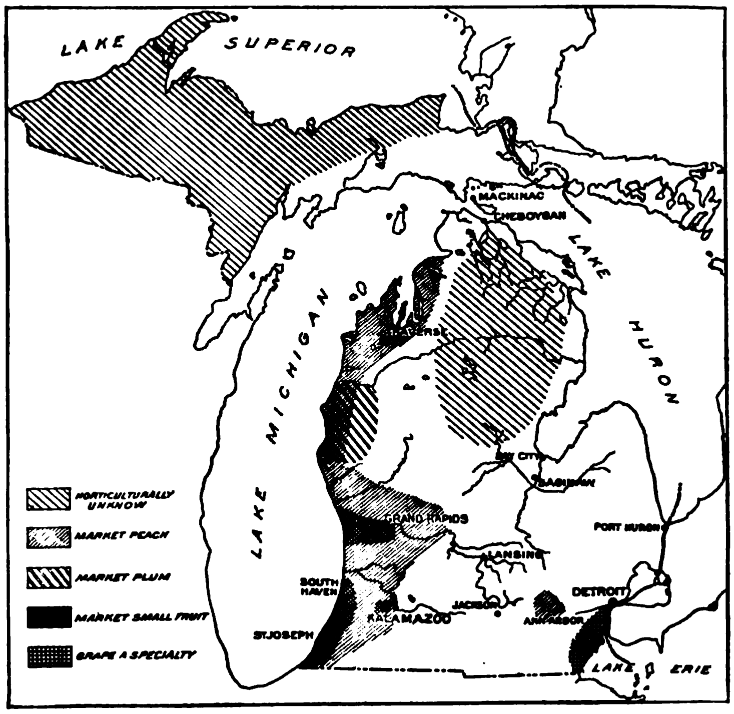
There was a wide range of wild fruits indigenous to Michigan, and the early seeds of apples and pears brought by the French missionaries produced trees of wonderful vigor and fruitfulness. Many of these trees are still standing in the vicinity of the old missionary stations. For a good many years after the early settlements in the state, fruit and garden products were raised simply as an accompaniment of the farm home or the town garden. Market horticulture has followed the rapid growth of cities and the development of modern methods of transportation.

The apple-growing region covers the southern part, extending northward and covering what is known as the "Thumb" (south of Saginaw bay), reaching as far north on the Huron shore as the Straits of Mackinac, and on the western, with a somewhat wider belt, to and including the Grand Traverse region. This same area is well adapted to the growth of the pear, cherry, and most of the small fruits. Peach-growing for profit is followed in a rather narrow belt along the west shore of Michigan, technically denominated the "peach belt," and upon reliefs of ground over a much wider area, extending even twenty to forty miles toward the interior from Lake Michigan; the northern terminus of this belt is Grand Traverse bay. At the date of this writing (1900) the most promising apple region lies in the middle-western part of the lower peninsula. The aggregate acreage devoted to apple-growing in the 39 apple counties is 202,587; and the acreage of peaches in the 12 counties in which this fruit is grown commercially is 39,051.

In the evolution of commercial horticulture in Michigan, specialties have been developed and we find the peach a leading product wherever it can be successfully grown. To illustrate the rapid increase of peach-growing in the state, it is enough to say that the average number of trees planted in the state annually, between 1890 and 1900, was 750,000. The shipments from the western part of the state are uniformly large, and the aggregates are often, in productive years, enormous. The color of the fruit is not as high as we find it in southern latitudes, but the quality is superior. From the lake ports a large proportion of the peach crop is shipped to Milwaukee and Chicago for distribution, but from the interior places of shipment, peaches are distributed in every direction by rail. The development of the small fruit interest for market has been in the region of large cities and lake ports. From the cities at the mouth of the St. Joseph river, in the height of the small fruit season, it is not rare to have the shipments aggregate 20,000 bushels a day. The grape industry is widely scattered over the southern half of the lower peninsula. The country bordering on Lake Erie, from the character of the soil, has produced the finest quality of fruit. In recent years a great impetus has been given to this industry in the vicinity of Lawton, Van Buren county, from which point hundreds of carloads are shipped annually. Plums are grown over a large portion of the southern peninsula, and to some extent, in the northern peninsula, but the fruit reaches its greatest perfection in Oceana and Mason counties.

The wide range of horticultural products grown in this state, and the wonderful development of certain specialties, in localities suited to them, have been due to the admirable method of disseminating exact and valuable information upon horticultural subjects in every corner of the state. This has been accomplished by organization. The state horticultural society, with its numerous branches; the organizations devoted to commercial horticulture; granges, farmers' clubs and institutes, touching in their work, according to locality, the various branches of horticulture, have all been valuable means for disseminating information. The Fruit Catalogue of the Michigan Horticultural Society has been a text-book for every planter; this, in recent years, has been supplemented by admirable bulletins from the horticultural branch of the state experiment station; and the men who have entered horticulture as a profession, becoming leaders, have been singularly public-spirited and well equipped. Michigan fruit-growers have never been guilty of neglecting to exhibit their products in attractive ways at county, state, national, and even international expositions, thus creating a demand for information which could be readily supplied in the form of bulletins, reports, circulars, etc., by their progressive organizations.

Certain crops that were in early days considered to be simply garden products have developed to such an extent that now they are field crops; this is notably true of celery, chicory, mint, potatoes, cabbages, tomatoes, cucumbers and melons. The quick and satisfactory communication from the lake ports with the large cities of Illinois and Wisconsin has stimulated the culture of the muskmelon and tomato to such an extent that they are not now reckoned as garden crops. Kalamazoo celery is shipped over a large area of the civilized world. The soil seems admirably adapted to the production of a high grade of product, and the method of growing and handling has reached far toward perfection. It is true, also, that other points in the state are developing as celery centers, and giving their names to the exported



1399. Michigan, showing horticultural areas.

product; this applies to Grand Haven, Muskegon, Tecumseh, Ypsilanti and Ionia.

The lettuce industry, conducted under glass, has reached an extraordinary development in the vicinity of Grand Rapids, a variety having originated there admirably suited to the purpose, and at this writing half a million feet of glass are devoted to this crop. Recently, the plaster caves at Grand Rapids have been found to be suited to the growth of mushrooms, and this is a growing horticultural industry. The glass structures devoted to lettuce are used for the growth of cucumbers, to supplement the lettuce crop, thus rendering it possible to utilize the glass for nine or ten months in the year. Parsley has also become a remunerative crop under glass, and the shipments to the large northern cities are rapidly increasing.

The flower trade is confined almost entirely to glass structures, and depends upon the wholesale market to take care of the output. Chicago seems to absorb everything of this kind in the western part of the state, while Detroit draws its supplies from the southeast portion. The carnation is the leading flower for export, and the soil of certain localities in western Michigan seems especially adapted to securing perfection in the flowers. Roses and violets in aggregate shipments follow the carnation closely.

The upper peninsula, as yet, is somewhat of an unknown quantity in horticulture, and still there are indications that in some localities the hardier fruits may be grown with the greatest success; from the market point of view, the small fruits, coming into the large centers late in the season, bring a remunerative price and extend the season. It is predicted by thoughtful horticulturists that because of the rapidity of development and marvelous growth in the short northern season, the upper peninsula will evolve a remarkably remunerative horticulture, peculiar to itself. The selection of varieties of the more perishable fruits, like berries and peaches, is modified largely by the fact that it is desirable to avoid competition with the flood of fruits from the South, so that the later ripening varieties are generally most popular with the market growers.

One of the important factors in fruit-growing along the shore of Lake Michigan is the tremendous volume of resort business. The whole shore, from St. Joseph to Mackinac, is dotted with resorts, and this population demands plenty of fruit of good quality, making the home market of no mean proportions. Nature designed Michigan for horticultural pursuits, and the progress of population has brought the right spirit into the culture of orchard and garden products. Everything indicates a most promising future for Michigan horticulture.

Charles W. Garfield.

The soil and climate of Michigan are well adapted to the production of high-grade seeds of many of our garden vegetables, and large areas are devoted to their cultivation. In 1899 a single firm of seedsmen had contracts with over 1,400 Michigan farmers for growing garden seeds of various kinds, and in 1900 contracts have been let to grow within the state at least 15,000 acres of garden varieties of peas, 10,000 acres of garden beans, 2,000 acres of sweet corn, 1,000 of cucumbers, 1,000 of melons, 500 of tomatoes, and smaller areas of onions, radishes, cabbage, etc., these crops being grown for seed alone. The seedsman contracts with farmers who are good cultivators and have good farms and buildings, to plant a certain area with choice selected seed furnished by the seedsman, who also does all necessary expert work in the roguing and cleaning of the crop and agrees to pay a specified price for all the seed produced. The seeds produced hitherto have proved of such exceptionally good quality that most American seedsmen are coming to depend largely upon this state for their supply of many sorts, and there is a steadily growing demand for Michigan seed for export.

W. W. Tracy.

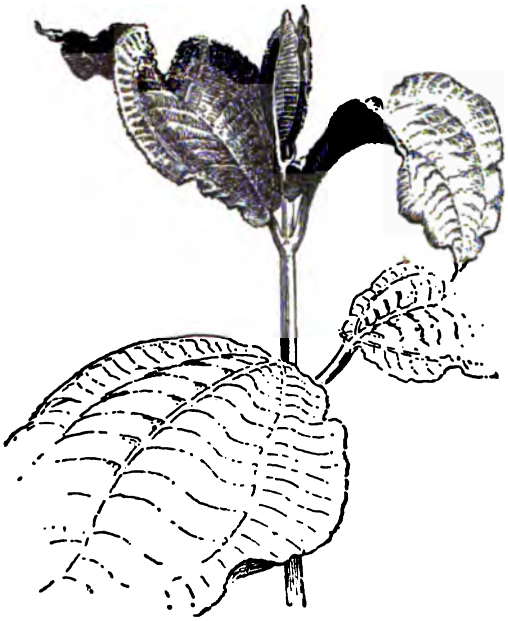
MICÒNIA (D. Micon, Spanish botanist). *Melastomàceæ.* Cogniaux, the latest monographer (DC. Monogr. Phaner. 7) admits 518 species to this genus, including the plants known to the trade as Cyanophyllums. The most popular of these greenhouse plants, *Cyanophyllum magnificum*, is placed amongst the species which are imperfectly known and is not described in the monograph. It was first illustrated and described as long ago as 1859. Miconia is a tropical American genus of trees and shrubs, with large and showy opposite or verticillate, strongly veined lvs. Petals 4–8, rounded at the apex, spreading or reflexed. Stamens variable in number and shape, but usually 8–16, the anthers polymorphous. Fr. a dry or leathery berry, 2–5-loculed, and few- or many-seeded. Fls. relatively small, usually corymbose or paniculate, white, rose, purple or yellow.

The Miconias of gardeners are conservatory or warmhouse subjects, grown for their large and striking foliage. They belong to the old genus Cyanophyllum, in which the anthers are subulate and incurved and with a single pore, the fls. large and the calyx oblong or campanulate and truncate or dentate. They propagate by cuttings of the firm wood over bottom heat. The plants should be screened from the direct glare of the sun, and be given abundance of water. Use a fibrous soil. Culture similar to that of Medinilla.

Since the plants are known to gardeners mostly for their foliage, it is probable that some of the trade species are referred to wrong genera. Flowers are not always known when the plants are named. Some of the names have no standing in botanical literature.

magnífica, Triana (*Cyanophýllum magníficum*, Groenl.). Fig. 1400. Reaching several feet in height as grown under glass (probably a tree in its native place), robust: lvs. very large (becoming 2–2½ ft. long), broad-ovate and wavy-edged, arched, rugose, upper surface lustrous green, lower surface red, the very prominent veins white or light-colored: fls. small, panicled. Mex. R.H. 1859, p. 359.—Discovered by Ghiesbrecht and first shown by Linden in 1857. One of the best and most striking of all conservatory foliage subjects. Voss (Blumengärtnerei) revives for this species the genus Tamonea and calls it *T. magnifica*, Voss. **M. velùtina**, Lind. & Rod. (I.H. 41:21), of Brazil, is perhaps a form of this species. Its lvs. are not arched and the colors are more bronzy.

spectánda, Rod. (*Cyanophýllum spectándum*, Nichols.). Lvs. oval, 1⅓ ft. or less long, 6–7 in. broad in the middle, the upper surface dark lustrous green, the under side greenish red, the midrib prominent and gray. Brazil.



1400. Miconia magnifica.
Known to the trade as *Cyanophyllum magnificum*.

Assámica (*Cyanophýllum Assámicum*, Hort.) was once offered by Saul. Said to be "a very beautiful foliage plant, with large, fine foliage." Probably a smaller type of *M. spectanda*, but very pretty when the lvs. are expanding. Said by Nicholson and Mottet to be much inferior to the above. L. H. B.

MICROKÉNTIA (Greek, *minute Kentia*). *Palmàceæ*. Here may belong the plant known to the trade as *Kentia gracilis*. Microkentia is a genus of 6 species of palms from New Caledonia. They are unarmed, with slender, bamboo-like, ringed trunks. The leaf segments are long-sword-shaped and distinct, or the upper ones grown together into a broad 2-cut blade. The fruits in this genus are amongst the smallest in the palm family. The fls. also are minute. The true Kentias, of which perhaps none is cultivated, have larger fls. and fruits, the former white, the latter vermilion. The anthers are fixed at the base in Kentia, but dorsifixed and versatile in Microkentia. Microkentia is nearer Clinostigma and Cyphosperma, but in these the leaf segments are irregularly bitten off at the apex. *Kentia gracilis*, Brong. & Gris. = *Microkentia gracilis*, Benth. & Hook. It is possible that the *Kentia gracilis* of the trade is *Kentiopsis divaricata* (which see).

MICROLÈPIA (Greek, *a small scale;* alluding to the indusium). *Polypodiàceæ*. A genus of graceful greenhouse ferns, allied to Davallia, but having the shallow, half-cup-shaped, membranous indusium attached to the sides as well as the base; the stalks are also continuous with the rootstock, and not joined to them, as in the true Davallias. Twenty or more species are known. For cultivation, see *Davallia*.

A. *Lvs. once-pinnate.*

marginàlis, Baker (*M. scàbra*, Hort.). Lvs. rising from a creeping rootstock, 18–24 in. long, 9–15 in. wide, with linear pinnæ, which are cut about half way to the rachis into bluntish, oblong lobes. Ceylon to China.

B. *Lvs. tri-quadripinnatifid.*

platyphýlla, Don. Lvs. 3–4 ft. long, on stout stalks from a stout, scaly rootstock, tripinnatifid; ultimate divisions broad, bluntish, toothed, oblong, deltoid; sori 2–12 to a segment, one in each tooth. India to Japan.

hírta, Kaulf. Lvs. 3–6 ft. long, on stout stalks, tri-quadripinnatifid; ultimate divisions oblong, broadly toothed; rachises hairy or pubescent; sori 2–20 to a segment, 1 or more together at the base of the teeth. India and Polynesia. Var. **cristata** is also offered by the trade. F. 1878, p. 59. Gn. 31, p. 428. F. R. 1:769.—*M. cristata*, Hort., presumably belongs here.

M. hispida, Hort.=? L. M. UNDERWOOD.

MICROMÈRIA (*mikros*, small, *meris*, a part: small-flowered). *Labiàtæ*. This genus comprises about 60 species of herbs and subshrubs, generally distributed in tropical and temperate regions, especially in the Mediterranean countries. Lvs. usually small, entire or toothed: whorls axillary or in terminal spikes: fls. small; calyx 13-nerved, 5-toothed or 2-lipped, corolla 2-lipped, upper lip erect, flattish, entire or notched, lower spreading, 5-lobed; stamens 4.

A. *Fls. 1–3 in the axils.*

Doùglasii, Benth. YERBA BUENA. Perennial: stems long, slender, trailing and creeping, with sweet-scented round or oval lvs., 1 in. or less across: fls. purplish, mostly solitary in the axils, on long, 2-bracted pedicels. Woodlands, from Vancouver's Is. to S. Calif. Sandy soil.—Offered by E. Gillett, 1881.

AA. *Fls. numerous in the axils.*

rupéstris, Benth. A dense, low-growing perennial plant, woody at the base, with prostrate stems, which turn up at the extremities, giving a heath-like effect when in bloom. Lvs. have the odor and taste of pennyroyal: fls. abundant, small, white, with lavender spots on the inner side of corolla lobes, borne for several inches along the stems. Prop. from cuttings and seeds. J. N. Gerard writes that it blooms from July until heavy frosts, and proves very satisfactory for rockery and informal border. Not advertised in American catalogues, but is in cult. by amateurs. S. Eu. M. B. COULSTON.

MICRÓSTYLIS (Greek, *small style*). *Orchidàceæ*. About a dozen species of this genus are in cultivation in the Old World. No species have found their way into the American trade. They are herbs of terrestrial habit, cult. for their richly colored lvs. The species in cult. are all from tropical countries, and require a close, damp house or, better, a Wardian case or bell-jar, within which the air may be kept moist enough for their requirements. The lvs. are more or less broadly ovate, rather succulent, with sheathing bases. They are mostly beautifully colored. The fls. are borne in terminal racemes, like those of Goodyera.

HEINRICH HASSELBRING.

The Mycrostylis are deciduous orchids. They grow well in the warm end of the cattleya department, or better still treated like thunias or calanthes,—a rather warm, moist atmosphere when growing in spring, reducing the same toward late summer as they begin to lose their foliage, and eventually resting them quite dry in a temperature of about 60° F. during winter. They will probably suffer in a Wardian case or bell-glass. They certainly will after growth is completed, if not at all times. R. M. GREY.

MIGNONETTE (Fig. 1401) is a universal favorite. Though there are many fragrant flowers of easy cultivation that exceed the Mignonette in beauty, it is probable that no other flower is so generally grown for fragrance. No home garden is complete without some Mignonette. It needs a cool soil, only moderately rich, shade part of the day, and careful attention to cutting the flower-stalks before the seeds are ripe. It grows 1–2 ft. high, and is treated as a half-hardy annual. If a sowing be made in late April, followed by a second sowing in early July, the season may be extended until severe frosts. Those who wish to have home-grown Mignonette in the window during winter may sow seeds in pots late in summer. Few flowers will prove as disappointing if the treatment it needs is omitted.

Years ago Mignonette was one of the few fashionable flowers. Every florist grew a little. With the rise of florists' roses, carnations, violets and chrysanthemums the Mignonette lost some of its relative importance, but within recent years a new era has opened for it. It is now a highly specialized crop, being little grown by general florists, but grown on a large scale by a few specialists.

For the botanical status of Mignonette, see *Reseda*.

C. E. Hunn.

Wholesale Cultivation of Mignonette.—Owing to improved methods of cultivation practiced in recent years, Mignonette has become a staple in the cosmopolitan markets. A few years ago growers contented themselves with little attention to the plant, letting it take care of itself after planting the seed in a row along the side of rose beds or benches. Now, however, certain growers having made its cutting and seed a specialty, the result has been the production of improved strains finding such favor that the old, careless methods are abandoned. As yet, well-grown plants in pots are not offered to the public, but the indications are that before long they will take their place as favorite Christmas and Easter plants, for which they are well fitted, since they are useful house plants in their keeping and odoriferous qualities.

Mignonettes in beds or benches for winter-flowering will succeed in almost any soil, but the best is a good, turfy loam, taken from an old pasture plowed as early as possible in spring after the grass begins to grow nicely. In the preparation of this soil, the pasture should be plowed about 4 inches deep and the earth heaped up immediately after plowing. When heaping, a layer of soil should first be made, then a layer of manure, and so on until the heap is completed, the top rounded off a little so as to throw off the surplus water of heavy rains. One load of good cow manure to six of soil would be about the right proportion.

If the plant is grown in beds, eight inches of soil will be sufficient, and the beds should rise slightly from the sides to allow for settling. The rough parts should be raked off, and a board laid on the soil and tramped upon until the soil is firmed evenly. Rake it again to roughen the surface, mark out rows lengthwise a foot apart, with cross rows at the same distance. Sow the seeds in the corners of the square thus made, cover very lightly, and when the sowing is completed, give a light watering with a fine rose watering-pot to settle the soil around the seeds. After the plants are up and growing and have made their second leaves, thin out to one plant, leaving the strongest one. Care should be taken at this time not to over-water, as it is preferable to leave the soil rather dry than wet. As soon as the plants are large enough, stake them all and tie them loosely to prevent them from falling out.

If the seed is sown in July for a November crop, the ventilators must be kept open day and night so as to admit all the air possible, in order to keep the plants stocky and short-jointed. Temporary shading in the middle of the day when the sun is hot is very necessary.

After the plants begin to show the flower heads, all the side shoots should be removed from around the heads down to the stem. Leave three or four of the strong bottom side shoots to come on for a second crop, and so on as the crop matures. Always have another crop coming on to take the place of the one that was cut. By keeping the plants neatly staked and tied there should be a continuous crop from November to May. When the plants have reached a good size, watering is of the utmost importance and should be done in the mornings and only on bright days, so that the foliage may be dry before night; for if the water lies on the foliage for twenty-four hours the leaves will become spotted and a fungous growth started, to the ruin of the plant. A night temperature of 45°, with a rise of 10° or 15° in the day, suits the plant very well. Mignonette will succeed in almost any kind of a glass structure, but, of course, the better the house the finer the product.

The cultivation of Mignonettes in pots requires much attention, involving careful watering, staking and training of the plants into the shape required. All this takes time, but good specimen plants in pots of 8 inches, with 15–20 heads of flowers to a plant, will repay the grower for all the attention bestowed. The best method for this kind of growing is to fill up 2-inch pots with finely sifted soil from the compost heap described before, then add one-third leaf-soil run through a sieve, with a little sand to make it porous, and then, pressing the soil firm, make a little hole with the finger in the center of the pot, drop in 2 or 3 seeds, cover lightly and water with a fine rose to settle the soil around the seed. After the plants are up thin out to one plant to a pot, leaving the strongest one. Keep all the plants as near the glass as possible to prevent them from becoming drawn. Be careful not to let the plants get dry at this time. If they receive a check at this or any time for want of water they get hard and will never make good plants afterwards. When the plants have filled the pots with roots shift to 4-inch pots, using a little rougher soil. Never allow the plants to become pot-bound. Up to this time they will not require stakes if kept near the glass with plenty of ventilation and are carefully watered. When the young roots begin to show through the soil at the sides of the pot shift to 8-inch pots, using good rough soil. Drainage must be provided at the bottom of the pots—broken bricks will answer the purpose. Cover this drainage

1401. Mignonette—Allen's Defiance.

material with a little rough stuff from the potting bench and pot the plants firmly, leaving the space of an inch at the top of the pot for water. Watering should be done sparingly until the plants fill the pots with roots. By this time the plants should be 4 inches tall, and the center shoot should now be pinched out to induce enough of the side shoots to form the foundation of the plants. The center shoot will produce 2 or 3 side shoots below where it was pinched, and with 6 or 7 bottom side shoots will form the basis of the plant. Rub off any other side shoots as they appear. After the plants have grown to a height of 6 or 7 inches they must be staked and tied; a stake in the center for the center shoot and one for the side shoots will be sufficient. After the plants have attained a height of 10 or 12 inches, and before the flower heads begin to show, pinch the center out of all the shoots with the finger and thumb at the same time so as to induce the plant to flower all at one time, for if pinched two or three weeks apart the flower heads will come irregularly and the plants will not look so well. As soon as the flower heads begin to show the plants should have a little weak liquid manure twice a week and as they develop and the roots get crowded in the pots they will require more feeding. Put about a bushel of sheep manure in a bag and drop it in a barrel of water for two or three days before using. This makes a very good liquid food for the plants; also chicken manure treated the same way but used in lesser quantity—about a half a bushel to 50 gallons of water will be about right. If the plants have been carefully watered and attention paid to staking and training, the grower will be amply rewarded with nice specimen plants having from 12 to 20 flower spikes to a plant.

Seed-saving.—Plants wanted for seed should be carefully selected. Only the very best plants with clean, healthy foliage and large bracts or flower heads, with the florets set close together, are the ideal plants for seed. If the plants are growing in a house or near other plants that are not so good they should be covered with mosquito netting to prevent the bees from cross-fertilizing them. After the heads have set, say from 20–25 pods, the center should be pinched out, for if allowed to grow and set more the seed will be of an inferior quality. When the seed begins to turn brown in the seed-pods the pods should be picked off and laid in an airy room for a day or two on paper, so that none may be lost. After the pods are dry, so that the seed will rub out clean, the seed should be cleaned, put in a package and placed in tin boxes to keep from mice, as these pests are very fond of it.

Robert McMillen.

MIGNONETTE VINE. See *Boussingaultia*.

MIKÀNIA (Prof. J. G. Mikan, of Prague, or his son and successor, J. C. Mikan, who collected in Brazil). *Compósitæ.* This includes *M. scandens*, the Climbing Hempweed, a common native weed, but a pretty one. It has distinct foliage, the lvs. being somewhat heart-shaped or halberd-shaped, and long-acuminate. The fls. are very small, numerous, pinkish, and borne in dense clusters 1–2 in. across. These clusters, as in all the species, are composed of many small heads, each containing 4 fls., surrounded by an involucre of 4 bracts. The genus contains about 60 species, mostly found in the warmer parts of America. Shrubs or herbs, the latter twining, rarely erect: lvs. opposite, usually stalked: heads spicate, racemose, corymbose or panicled: fls. mostly white or yellowish. Nearest to Eupatorium, but the latter has an indefinite number of involucral bracts instead of 4, and contains erect plants.

scándens, Willd. Climbing Hempweed. Described above. Moist ground, New Eng. to Fla. and Tex. G.W.F. 34.—Very rarely offered by dealers in native plants.

Sánderi, Hort. Hothouse climbers, with variegated foliage. Int. 1899 by Sander & Co., who say the lvs. are richly embellished with dark velvet-purple patches; veins of mature lvs. white. The lvs. are about 6 in. long, 5 in. wide, boldly toothed.

M. violàcea, offered by Pitcher & Manda in 1895, is little known.

MILDEW. This name is given to a group of fungous diseases which attack leaves, shoots, flowers and fruits. The true or powdery Mildews (Erysipheæ) appear as a thin, white, powdery coating on the surface of the plants. The disease is usually accompanied by distortion and dwarfing, and often death of the affected parts. In some cases, however, as in the maple Mildew, the affected areas of the leaves retain their chlorophyl and remain green in the autumn long after the rest of the leaf is dead and yellow. The mycelium is always superficial, forming spots or more or less extended areas on the affected organs. The injury is done by numerous haustoria, which penetrate the cells of the host and absorb nutriment for the mycelium, and also serve as organs of attachment. During the summer Mildews are propagated by 1-celled spores, many of which are cut off in succession from erect, simple branches all over the diseased surface. Other spores, by means of which the fungus passes through the winter, are produced in sacs inclosed within hollow spherical receptacles, called perithecia. These appear as minute black or dark brown specks over the diseased area. They are produced in the autumn, and remain on the fallen leaves; but the spores within them do not ripen until the following spring, when they are liberated by the decay of the perithecia.

In the United States, considerable injury is caused by the following species: The rose Mildew, *Sphærotheca pannosa*, on roses under glass; *Erysiphe graminis* on wheat and other grasses; the vine Mildew, *Uncinula spiralis*, producing the powdery Mildew of grapes; *Podosphæra Oxycanthæ* on apples and pears; and *Sphærotheca Castagnei*, the hop Mildew. The most successful mode of combatting the Mildews is by dusting with sulfur or spraying with Bordeaux mixture. Either of these fungicides kills the mycelium and spores of the fungus.

The downy Mildews or false Mildews belong to the Peronosporeæ, a group of fungi widely separated from the true Mildews. The mycelium is parasitic within the tissues of the host, only the fruiting branches appearing at the surface (see Fig. 879). The fruiting branches have a characteristic form and method of ramification for each genus of the group. The spores, when they lodge on new host-plants, either produce an infecting thread directly, or, in most cases, the contents of the spore is discharged in the form of swarm-spores, which swim about for a time and finally come to rest and produce the infecting mycelium. Resting spores are produced sexually in this group within the tissues of the host.

This family contains about ten genera, of which the following are most commonly known: *Phytophthora infestans*, the potato blight; *Plasmopara viticola*, the downy Mildew of grapes; *Bremia Lactucæ*, often causing great damage to lettuce in forcing-houses; *Pythium Debaryanum*, causing damping-off of seedling cucumbers and various other seedling plants; and *Cystopus candidus*, the common white rust of crucifers. Modes of combatting these diseases are set forth for each specific case in the experiment station literature of the various states. See, also, *Diseases*.

Heinrich Hasselbring.

MILFOIL. See *Achillea*.

MÍLIUM (ancient Latin name of Millet, which, however, belongs to a different genus). *Gramíneæ.* Millet Grass. Contains 5–6 species distributed through temperate Europe and Asia, one of which is also found in North America, and is occasionally cult. for ornament. Spikelets 1-fld., in diffuse panicles. Empty glumes awnless, the flowering glume coriaceous, as in Panicum. Farmer's Bulletin, No. 101, issued by the U. S. Dept. of Agric. is devoted to Millets (but not to Milium).

effùsum, Linn. A smooth perennial, 3–6 ft. high: lvs. broad and thin: panicle 6–9 in. long.

A. S. Hitchcock.

MILK PEA. *Galactia*.

MILK VETCH. *Astragalus*.

MILKWEED. *Asclepias* in general; *A. Cornuti* in particular.

MILKWORT. *Polygala*.

MÌLLA (J. Milla was head gardener at the Court of Madrid). *Liliàceæ.* Bentham & Hooker restrict the genus Milla (as Cavanilles, its author, intended) to one species, *M. biflora.* From Brodiæa the genus differs in the fact that the pedicels are not jointed and the perianth segments are always 3-nerved. Milla and Brodiæa are native to the northern half of the western hemisphere. In South America is the genus Triteleia, which is by some referred to Milla, by others to Brodiæa, and by still others kept distinct. There is one Triteleia (*T. uniflora*) in common cultivation. In his monograph (Journ Linn. Soc. 11, p. 378), Baker refers the Triteleias to Milla, and this disposition is followed by Index Kewensis, but in a later account (G.C. III. 20, p. 459) he refers them to Brodiæa. Watson (Proc. Amer. Acad. Arts. & Sci. 9, p. 240) restricts Milla to one species. The North American plants which have been referred to Triteleia are perhaps best treated as Brodiæas, and they are so considered in the account of that genus in Vol. I of this work. The South American Triteleias are described under that genus in Vol. IV.

Milla has a salverform perianth, with 3-nerved segments which are separate nearly to the base, 6 nearly sessile stamens in one row, sessile, oblong-obovate capsule. **M. biflòra,** Cav., has a scape 6–18 in. high from a small coated bulb, bearing 1–5 (usually 2) star-like, waxy white, fragrant fls. 2–2½ in. across, with oblong-lanceolate segments: lvs. rough, nearly terete. S. Ariz. and New Mex. to central Mex. B.R. 18:1555. F.S. 14:1459. Gn. 24, p. 155.

Milla biflora is one of the best of the small bulbs. It known as Mexican Star, Mexican Star of Bethlehem, Frost Flower, and Floating Star. The fls. are of a charming waxy consistence, and are borne on long stems. They are excellent for cutting, and last several days. Planted in the border early in spring, they soon throw up their fls. and lvs. They should be allowed to remain until September or October, when they may be taken up and stored for the winter. Our gardeners know Milla mostly as a pot bulb for flowering under glass late in winter or early in spring. It blooms readily in the conditions given to Freesias. Several bulbs should be placed in a pot, although several stalks will spring from one bulb.

L. H. B.

MÌLLER, DUSTY. See *Lychnis Coronaria.*

MILLETS are important agricultural grasses. The true Millet or **Broomcorn Millet** of Europe is *Panicum milaceum.* The common Millets of the United States, the **Foxtail Millets,** are forms of *Setaria Italica.* **African Millet,** also called Black, Chinese, Indian, and improperly Pearl Millet, is *Sorghum vulgare.* The name African Millet is sometimes applied to *Eleusine Coracana.* **Barnyard** or **Japanese Millet** is *Panicum Crus-galli.* **Pearl Millet** is *Pennisetum typhoideum.*

A. S. HITCHCOCK.

MILLÉTTIA (named in honor of Dr. Millett, of Canton, China). *Leguminòsæ.* About 40 species of Old World tropical trees and large shrubs, usually climbers; differs from the Japanese and North American genus Wistaria only in the hard, usually flat and thick pod not opening so readily. Lvs. large, odd-pinnate; lfts. opposite, stipellate: fls. showy, in axillary racemes often fascicled, simple or paniculate and terminal, white, purple or reddish.

A. *Fls. purple.*

Cáffra, Meissn. IRON-WOOD. A South African tree, 20–30 ft. high, with very hard, close-grained, brown wood and dark, rough, rugulose bark. Lvs. on channeled petioles 6–8 in. long; lfts. lanceolate-oblong, acute, in 5–6 pairs, 2–2½ in. long, 1 in. apart; slender stipules 2–3 lines long: panicle 6–8 in. long: fr. leathery, velvety, used as a medicine by the Kaffirs. Int. by Reasoner Bros., 1891.

AA. *Fls. white.*

Japónica, Gray. A Japanese woody climber. Lvs. light green, odd-pinnate; lfts. narrowly ovate, 4–6 pairs, 1½ in. long, 1 in. apart: racemes simple, nodding, 5–8 in. long. Probably not hardy in the North. Procurable of dealers in Japanese plants. S.Z. 1:43 (*Wistaria Japonica*).

MILTÒNIA (named for Lord Fitzwilliam, Viscount Milton, a patron of horticulture). *Orchidàceæ.* This group contains some of the most beautiful orchids in cultivation. The pseudobulbs are closely clustered and sheathed with long, graceful, dark green lvs., forming plants over 1 ft. in diameter, bearing numerous large fls. They are herbs with short pseudobulbs, bearing 1–2 lvs. at the summit and few or many sheathing lvs. at the base: the inflorescence arises from the base of the pseudobulbs, and consists of a single-fld. peduncle or of a loose raceme of long-pedicelled fls.: sepals subequal, spreading, free or the lateral ones slightly united; petals similar or a little wider; labellum not distinctly clawed, large, expanded, not 3-lobed, but often bifid at the apex: both the segments and the labellum are expanded, forming a flat flower: column short. This genus contains nearly 20 species, mostly from Brazil. They are closely related to Odontoglossum and Oncidium, but may be distinguished by the characters given above. *M. Rœzlii, M. vexillaria,* and some closely related kinds were until recently known in gardens as Odontoglossums. In the group containing the "true" Miltonias, the pseudobulbs are separated from each other on the rhizome, and bear 1–2 yellowish green lvs. at the summit and few sheathing lvs. of the same color at the base. The fls. of nearly all Miltonias remain on the plants in a fresh condition for a month or more.

HEINRICH HASSELBRING.

1402. Miltonia vexillaria.

The Colombian species of Miltonia, among which are *M. vexillaria* and *M. Rœzlii,* grow best in a compost of well-chopped, turfy fern root and very coarse river sand or pulverized coal clinkers. Do not overpot. Finish with sphagnum, which should be kept growing. These species should have a temperature of 58° to 70°. They do not like a close atmosphere, but a good and constant circulation of air. Fumigate slightly once a week or scatter strong tobacco dust on the wet, hot pipes frequently to control thrips. After growth is finished, these orchids should be carefully rested in a temperature of 55° to 60°, but at no time should they become very dry.

All the Brazilian kinds enjoy plenty of diffuse, but not direct, sunlight. They need much water while growing. After growth is complete, gradually withhold water supply. The Brazilian kinds grow best in shallow perforated pans, with plenty of drainage, and potted in fern root mixed with coarse leaf-mold and sharp sand.

M. vexillaria, as grown by the respected William Gray, of Albany, was well worth a long journey to see. He had specimens in 12-inch pans in perfect health and condition, which were a lovely sight. When asked for the secret of his notable success, Mr. Gray pointed overhead to the ventilators (outside temperature 20°), which were open just enough at top and bottom to allow a gentle circulation of air. Mr. Gray added that he kept up plenty of atmospheric moisture and was very careful about overhead waterings on close, warm days.

WM. MATHEWS.

Though the genus Miltonia is closely allied to Odontoglossum botanically, the cultural requirements are in many cases very different. Species Nos. 1, 2, 3, 4 and 10 do well under the same general conditions of culture recommended for *Odontoglossum crispum* (which see), but 5° more heat during the winter months should be given them.

M. spectabilis and *M. flavescens* should be grown in baskets or pans suspended from the roof in a compost of clean, chopped peat fiber and live sphagnum, liberally interspersed with pieces of charcoal, to which the roots freely attach themselves. They can, if desired, also be grown on orchid rafts with a little compost between. They require stovehouse temperature, a moist atmosphere and a copious supply of water both at the roots and overhead when growing.

M. candida, *M. cuneata* and allied species thrive best in liberally drained pots or pans in a compost of rough, chopped peat and sphagnum, interspersed with pieces of broken charcoal.

A warm, moist, shady location, such as is afforded in the Cattleya or Cypripedium department, where the temperature can be maintained at 60° to 65° by night and about 70° by day during winter, suits Miltonias best. The compost should never be allowed to become dry during the growing season, and should never remain dry long even when at rest during winter. Overhead syringing is necessary at all seasons to keep down thrip, to which this group is subject. Weak liquid cow manure applied occasionally during the period of growth is beneficial. Cutting the rhizome between the pseudobulbs, partly through, at the beginning of the growing season will retard the sap and often induce the latent eyes to grow, after which time the pieces may be removed and potted up separately. By this means the stock is increased.

R. M. GREY.

INDEX.

alba, 1.
bicolor, 5.
candida, 8.
Clowesii, 7.
cuneata, 9.
Endresii, 3.
flavescens, 12.
gigantea, 2.
grandiflora, 2, 12.
luxurians, 4.
Moreliana, 5.
Oncidium, 10, 11.
Phalænopsis, 4.
picta, 2.
purpurea, 6.
Regnelli, 6.
Rœzlii, 1.
rosea, 2.
Russelliana, 11.
spectabilis, 5.
vexillaria, 2.
Warscewiczii, 10.
Weltoni, 10.

A. *Pseudobulbs crowded, with numerous dark or gray-green sheathing lvs. at the base.*
  B. *Labellum sagittate at the base.* 1. **Rœzlii**
    2. **vexillaria**
  BB. *Labellum not sagittate, constricted in the middle, i. e., broadly panduriform* .... 3. **Endresii**
    4. **Phalænopsis**
AA. *Pseudobulbs situated at intervals on the rhizome, with few yellowish green lvs.*
  B. *Segments of perianth broad, ovate to oblong.*
    C. *Perianth uniformly colored white, rose or purple*...... 5. **spectabilis**
      6. **Regnelli**
    CC. *Perianth variegated, yellow and brown or brown and green.*
      D. *Labellum fiddle-shaped* .. 7. **Clowesii**
      DD. *Labellum broadly obovate.* 8. **candida**
        9. **cuneata**
      DDD. *Labellum oblong* ....10. **Wárscewiczii**
        11. **Russelliana**
  BB. *Segments of perianth linear-lanceolate* ....12. **flavescens**

1. **Rœ́zlii**, Nichols. (*Odontoglóssum Rœ́zlii*, Reichb. f.). Pseudobulbs narrowly ovate, 1–2 in. long: lvs. numerous, slender, 8–12 in. long, narrowly linear-lanceolate: scapes about half as long as the lvs., bearing 2–3 large fls.: fls. flat, 3–3½ in. across, pure white, with a purple band at the base of the petals and a yellow stain, more or less marked with reddish brown, at the base of the labellum; sepals and petals ovate-oblong, acute; labellum large, broadly obcordate, with a tooth in the sinus, and a spur-like horn projecting backwards on each side of the column. Closely allied to *M. vexillaria*, from which it differs in color and by the more slender, nerved lvs. Flowers twice a year in winter and spring. Colombia. B.M. 6085. I.H. 23:228. R.H. 1875:450. Gn. 4, p. 251; 10:31; 26:457.—Var. **álba**, Hort. Fls. large, lacking the purple band on the petals. Gn. 26:457. F.M. 1875:164. A.F. 13:1453. Gng. 6:327.

2. **vexillària**, Nichols. (*Odontoglóssum vexillàrium*, Reichb. f.). Fig. 1402. Pseudobulbs 1½–2 in. long: lvs. 6–12 in. long, narrowly elliptic-lanceolate: scapes sometimes 6 from a single pseudobulb, slender, and longer than the lvs., 3–4-fld: fls. the largest of the genus, flat, about 4 in. long; sepals and petals ovate-oblong or obovate, pale or dark rose, sometimes with white margins; labellum large, rounded, deeply emarginate, narrowed to a sagittate claw, deep rose, whitish at the base, streaked with yellow and red. The fls. are extremely variable in shape and color. Spring and early summer. Western slope of the Andes, Colombia. B. M. 6037. I.H. 20:113. F.S. 20:2058. R.H. 1876:390. Gn. 9, p. 577; 10, p. 108; 17:231; 35, p. 268; 45, p. 536. G.C. II. 26:145; III. 18:743; III. 19:755; 27: May Suppl. J.H. III. 31:301. G.F. 8:195. G. M. 39:386. V. 5:138. A.F. 13:121.—One of the most popular of all orchids. There are several varieties of this plant. Vars. **gigantèa, grandiflòra, pícta, ròsea**, have been advertised under Odontoglossum.

3. **Éndresii**, Nichols. (*Odontoglóssum Warscewìczii*, Reichb. f.). Pseudobulbs small, tufted: lvs. numerous, distichous, elliptic-lanceolate, about 1 ft. long: scape as long as the lvs., inclined or drooping, 6–8-fld.: fls. 2–2½ in. in diameter, flat, white, with a yellow crest on the labellum and a rose-colored blotch at the base of each segment; sepals broadly ovate; petals elliptic; labellum very broadly fiddle-shaped and 2-lobed. Feb. Costa Rica. B.M. 6163.

4. **Phalænópsis**, Nichols. (*Odontoglóssum Phalænópsis*, Lind. & Reichb. f.). Pseudobulbs ovate, with grass-like lvs. 8–10 in. long at the base and apex: stalks 1–3-fld., shorter than the lvs.: fls. large, flat, white, with the labellum variegated and streaked with crimson; sepals 1 in. long, oblong, pointed; petals broader and rounded; labellum large, broadened and 2-lobed in front, constricted near the middle and expanded above into 2 rounded lobes. The pseudobulbs are clustered, forming clumps 1 ft. or more across, with numerous fls. mingled with the long, grass-like lvs. Spring and summer. Colombia. I. H. 3:109. Gn. 18, p. 447; 26. p. 232; 35. p. 269; 36, p. 315. G.C. II. 25:364. I.H. 28:417 (var. *luxurians*, more vivid).

5. **spectábilis**, Lindl. Rhizome creeping, with the pseudobulbs placed about 1 in. apart, with 2 lvs. at the apex and few sheathing lvs. at the base: lvs. linear-oblong, 4–12 in. long: scapes erect, sheathed, 6–8 in. long, bearing a single fl. about 4 in. in diameter: sepals and petals oblong, obtuse, slightly waved, white or cream-colored; labellum 2 in. long, very broad in front, pendent, somewhat undulate, rose-purple, with darker veins. The first Miltonia introduced into cultivation. It blossoms in autumn, large plants bearing from 20–50 fls., all opening at once and lasting about a month. Brazil. B.M. 4204. B.R. 23:1992. I.H. 6:216; 12:446 (var. *cereola*); 14:524 (var. *rosea*); 15:573 (var. *virginalis*). P. M. 7:97. K. W. 1:45 (*Macrochilus Fryanus*). R. B. 1889:25. G.M. 38:642. A.F. 6:631. Var. **bicolor**, Hort. Fls. white, with a violet spot on the labellum. Large-fld. and vigorous. Aug. Var. **Moreliàna**, Hort. (*M. Moreliàna*, Hort.). This variety is very distinct in color. Sepals and petals deep purple; labellum of the same color, veined and shaded with rose. In habit the plant is like the type in every detail. B.M. 4425 (as var. *purpureo-violacea*, Hook.). F. S. 10:1008. I. H. 2:71. Gn.

31:593 (habit poor). F.M. 1874:143. G.M. 40:37. F. 1850. p. 123 (outline). A.F. 6:633.

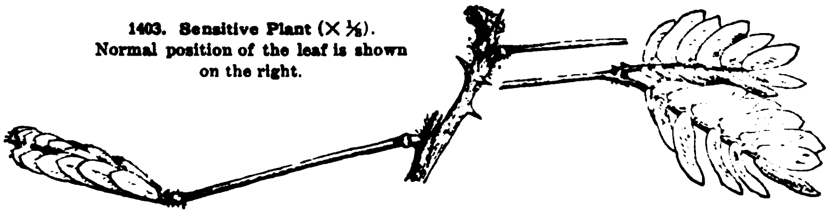
6. **Régnelli**, Reichb. f. Like *M. candida* in habit and foliage: lvs. 1 in. broad: scapes erect, bearing several large fls. over 2 in. in diam.: sepals and petals spreading, recurved at the apex, oblong, acute, white; labellum subpandurate, obtuse or emarginate, rose-purple, with deeper veins and 3 yellow keels at the base. Sept. Brazil. B.M. 5436.—Var. **purpùrea**, Pynært. Sepals and petals tinted with rose, with white margins; labellum crimson, with a white crest. R.B. 17:253.

7. **Clówesii**, Lindl. Pseudobulbs ovate-oblong, leafy at the base and bearing 2 narrow ensiform lvs. at the apex: scape erect, 1 ft. long, many-fld.: fls. 3 in. across, orange-yellow, mottled with brown, the lip white with a violet base; sepals and petals spreading, lanceolate, acuminate; labellum fiddle-shaped, with a cordate base and a broadly rotund, acute terminal portion. Resembles *M. candida*. Sept., Oct. Brazil. B.M. 4109. P.M. 9:241.

8. **cándida**, Lindl. Pseudobulbs ovate-oblong, 2-lvd., with few lvs. at base: lvs. oblong-linear, 1 ft. long, 1½ in. broad: raceme erect, 1 ft. long, 6–8-fld.: sepals and petals spreading, oblong, acute, somewhat wavy, bright yellow, with large red-brown blotches; labellum large, broadly obovate, convolute, crenate and wavy on the margin, white, changing to yellow, with a faint purple blotch. A strange species producing 5–6 racemes, each with 6–10 fls. about 2½ in. across. Autumn. Brazil. B.M. 3793 (var. *flavescens*). P.M. 6:241. Gn. 20, p. 463.

9. **cuneàta**, Lindl. Pseudobulbs ovate, clustered, 4 in. long, sheathed with lvs. at the base and 2-lvd. at the apex: lvs. dark green, strap-shaped, 1 ft. long: scape erect, 5–8-fld. as long as the lvs.: fls. 3–4 in. across; sepals and petals lanceolate, spreading, mostly chocolate brown, greenish yellow at the tips, and few spots of the same color; labellum obovate-rotund, slightly wavy, creamy white, with 2 parallel ridges on the crest. A robust, free-flowering plant of the habit of *M. candida*. Feb. Brazil. B.R. 31:8. I.H. 7:237.

10. **Warscewiczii**, Reichb. f. (*Odontoglóssum Wéltoni*, Hort. *Oncidium fuscàtum*, Reichb. f. *Oncidium Wéltoni*, Hort.). Pseudobulbs 3–5 in. long, much flattened: lvs. linear-oblong, obtuse, 5–6 in. long: fls. 2 in. long from the tips of the lip to that of the upper sepal, numerous, borne in a branched nodding panicle; sepals and petals cuneate-obovate, waved and crisped, pale reddish brown, with whitish tips; labellum oblong, fan-shaped, bifid, white, with a large rose-purple disk on the center of which is a large, brownish yellow blotch. March. Peru. B.M. 5843. F. S. 18:1831.



1403. Sensitive Plant (× ½).
Normal position of the leaf is shown on the right.

11. **Russelliàna**, Lindl. (*Oncidium Russelliànum*, Lindl.). Pseudobulbs ovate, ribbed, 2-lvd.: lvs. narrowly lanceolate: flower stems dark purple, few-fld.: sepals and petals ovate-oblong, somewhat undulate, brownish purple with green margins; labellum oblong-cuneate, retuse, apiculate, violet, the crests or lamellæ on the disk margined with white. Fls. rather small and dull in color. Dec. Brazil. B.R. 22:1830. P.M. 7:217.

12. **flavéscens**, Lindl. Pseudobulbs narrow: lvs. linear-ensiform: raceme many-fld., the stalk sheathed with bracts: fls. stellate, yellow, with the labellum somewhat spotted with purple; sepals and petals linear-lanceolate, acuminate; labellum pandurate, undulate-acuminate. June. Brazil. B.R. 19:1627. (*Cyrtochilum flavescens*).—Var. **grandiflòra**, Regel. Fls. larger, white at first, becoming whitish yellow; labellum obtuse. Gt. 39:1328.

M. bicolor and var. *candida* are advertised.—*M. Bleuàna*, Hort. (Miltonopsis Bleui, Bleu.). Garden hybrid between M. vexillaria and M. Rœzlii. Intermediate between the parents: fls. large, 4 in. across, white, with the bases of the segments tinged with rose-purple; labellum large, bilobed, veined with pink. The sepals and petals are well developed, making a full, rounded flower. A.F. 6:631. G.F. 5:198, 199. A.F. 9:1087 (both var. splendens).—*M. Pinélli*. No description available.

HEINRICH HASSELBRING.

MIMBRES. *Chilopsis saligna.*

MIMÒSA (Greek, *a mimic*, alluding to the fact that the leaves of some species are sensitive). *Leguminòsæ*. What the florists know as Mimosas are Acacias (chiefly *A. armata*). Mimosa has stamens 10 or less (once or twice as many as the petals); Acacia has numerous stamens. Of Mimosas there are between 200 and 300 species of tropical regions, chiefly of tropical America. Trees, shrubs or herbs (sometimes woody climbers), with bipinnate often sensitive lvs. (sometimes the lvs. reduced to phyllodia): fls. usually with 4 or 5 united petals, and a very minute or obsolete calyx: pollen granular: pod flat, oblong or linear, breaking up into 1-seeded joints when ripe.

A. *Herbaceous plants.*

pùdica, Linn. SENSITIVE PLANT. HUMBLE PLANT. Fig. 1403. Cult. as an annual, but probably perennial in the tropics, erect, branching, hairy and spiny: lvs. long-petioled, with 2 or 4 sub-digitate pinnate linear-oblong lfts.: fls. many, in globular-oblong heads on elongating axillary peduncles, purplish: pods comprising 3 or 4 spiny joints. Brazil, but widely naturalized in warm countries.—Easily grown from seeds, which are sold by seedsmen. The plant grows readily in any place in which garden beans will thrive. It is grown for its sensitive foliage. The movements are usually quickest in young plants. When the lvs. are touched, the petiole falls and the leaflets close. Neither the mechanism nor the utility of these movements is well understood. *M. sensitiva*, Linn., is a distinct plant (B.R. 1:25). It is a half-climbing perennial with 2 unequally pinnate lfts., not so sensitive as *M. pudica*. The word *pudica* is Latin for *modest* or *retiring*.

AA. *Woody plants.*

B. *Primary pinnæ 1 pair.*

Spegazzini, Pirotta. Spiny: pinnæ 2, bearing very numerous lfts.: fls. light purple, in globular heads or clusters: pod of 3 or 4 parts, spiny. Argentina.—Int. by Franceschi. Small tree.

BB. *Primary pinnæ 2 pairs.*

Guayaquilénsis, Steud. (*Acàcia Guayaquilénsis*, Desf.). Pinnæ 4, with 3–5 pairs of ovate-obtuse glaucous lfts., of which the lower ones are smaller: opposite stipular spines at the base of the leaf. Ecuador.

BBB. *Primary pinnæ 5 pairs.*

Ceratònia, Linn. (*Acàcia Ceratònia*, Willd.). Pinnæ about 5 pairs; lfts. obovate: pods glabrous, somewhat articulate and spiny. Small, spiny tree from W. Indies.

BBBB. *Primary pinnæ 6–8 pairs.*

acanthocárpa, Poir. (*Acàcia acanthocárpa*, Willd. *A. brachyacántha*, Humb. & Bonpl.). Pinnæ 12–14, with 6–15 pairs of oblong-pubescent lfts.: stipular spines 2: fls. in heads on twin axillary peduncles: pod falcate, spiny. Mex.—Bush or small tree.

Dénhardti, Tenore. Ornamental shrub: branches glabrous or minutely hairy, striate, usually bent at each thorn: lvs. hairy, the pinnæ 12–14, the ultimate lfts. small (⅙ in. long) and crowded and falcate-oblong-acute: fls. in club-shaped, axillary clusters: thorns 1–3 in. long. S. Amer.—Cult. in S. Calif. Int. by Franceschi.

L. H. B.

MÍMULUS (Latin, a *little mimic*, from the grinning fls.). *Scrophulariàceæ*. This genus includes the Monkey Flower, *M. luteus*, and the Musk Plant, *M. moschatus*. Monkey Flowers are something like snapdragons, though they do not have a closed throat. They are 2-lipped fls., with 2 upper and 3 lower lobes, which are all rounded and usually irregularly splashed and dotted with brown on a yellow ground. Though perennial, they are commonly treated as annuals and are considerably used for pot culture in winter, as well as for summer bloom outdoors. The Musk Plant is grown for its scented foliage and pale yellow fls. It is sometimes used in hanging baskets, but the foliage is so sticky that it gathers a great deal of dust.

Mimulus is a genus of about 40 species, mostly American: herbs, decumbent or erect, glabrous or pilose and clammy, rarely shrubby: lvs. opposite, entire or toothed: fls. axillary, solitary or becoming racemose by the reduction of the upper lvs.; calyx 5-angled, with 5 short or long teeth; corolla tube cylindrical, sometimes swelled at the throat; stamens 4, didynamous: capsule oblong or linear, loculicidally dehiscent.

The kinds described below are all perennial at least by underground parts, and most of them are natives of wet and shady places in northwestern America. Latest monograph by A. Gray in Syn. Flo. N. Amer., Vol. II, part 1, pp. 273, 442. They mostly grow 2–4 ft. high and bloom all summer. *Mimulus Californica* is advertised. Diplacus is generally referred to Mimulus. W. M.

The sight of Monkey Flowers always carries the writer back to boyhood days. A certain window on his way to school was brightened every spring by a fine display of Monkey Flowers and Musk. Though these two species were thus happily associated, it is doubtful whether the owner knew of their kinship. There is nothing difficult in the culture of Mimulus. Some of the finest plants have been self-sown on a rubbish heap. Abundance of water is essential. The seed has great vitality, and will germinate for many years in the place where once seeds have fallen. They are not hardy.

M. luteus, with its varieties and hybrids, particularly var. *maculosus*, is the best known. There are double and hose-in-hose varieties, but the single forms are the handsomest. It often self-sows in moist gardens. *M. cardinalis*, a handsome Californian perennial, is occasionally hardy, but does best treated as an annual. *M. glutinosa* is a pretty shrubby species, with coppery fls., once a common greenhouse plant, but rare enough now to be almost a novelty. T. D. HATFIELD.

INDEX.

alatus, 10.
alpinus, 1.
aurantiacus, 6.
cardinalis, 5.
Clevelandi, 7.
cupreus, 2.
gloriosus, 1.
glutinosus, 6.
hybridus, 1.
Lewisii, 4.
luteus, 1, 2.
maculosus, 1.
moschatus, 3.
parviflorus, 8.
quinquevulnerus, 1.
ringens, 9.
rivularis, 1.
Rœzlii, 1.
roseus, 4.
tigridioides, 1.
tigrinus, 1.
variegatus, 1.
Youngeana, 1.

A. *Color of fls. yellow, brown or brick-red.*

B. *Plants herbaceous.*

C. *Foliage not sticky or clammy* .. 1. **luteus**

2. **cupreus**

CC. *Foliage sticky and clammy.*

D. *Stamens not thrust out of the corolla.*

E. *Lvs. pinnately veined*.... 3. **moschatus**

EE. *Lvs. parallel-veined*..... 4. **Lewisii**

DD. *Stamens thrust out of the corolla* .... 5. **cardinalis**

BB. *Plants shrubby, at least at the base.*

C. *Lvs. linear, minutely toothed or entire*....................... 6. **glutinosus**

CC. *Lvs. lanceolate, serrate.*

D. *Fls. yellow*................. 7. **Clevelandi**

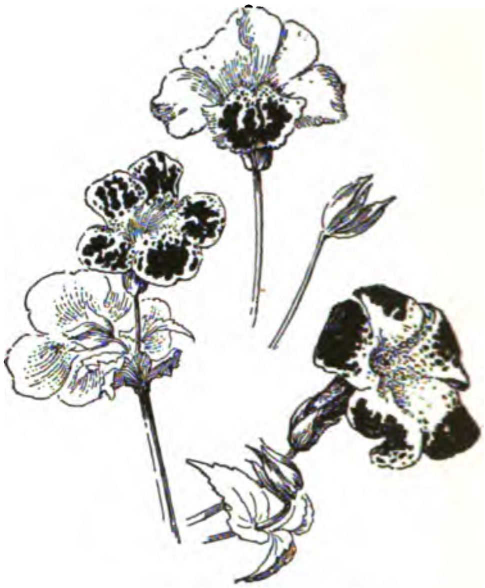
DD. *Fls. brick-red*...............8. **parviflorus**

AA. *Color of fls. violet, purple or lilac.*

B. *Lvs. stalkless: pedicels longer than fls*............................ 9. **ringens**

BB. *Lvs. stalked: pedicels shorter than the calyx*......................10. **alatus**

1. **lùteus**, Linn. MONKEY FLOWER. Fig. 1404. Glabrous, the larger forms 2–4 ft. high: lvs. parallel-veined, sharply toothed, upper ones smaller: corolla 1–2 in. long. Alaska to Chile. B.M. 1501.—Monkey Flowers nearly always have yellow throats with brown dots. The lobes are sometimes clear yellow. In var. **rivulàris**, Lindl., only one lobe has a large brown patch. B.R. 12:1030. L.B.C. 16:1575. In var. **Youngeàna**, Hook., every lobe has such a patch. B.M. 3363. B.R. 20:1674. In the common strains these patches are more or less broken up and the fls. irregularly mottled and dotted. F. 1863:73 (as *M. maculosus*). V. 10:289 (as *M. hybridus*). A very distinct set of colors is represented by var. **variegàtus**, Hook., the throat chiefly white, but with 2 yellow longitudinal lines dotted with brown on the middle lobe of the lower lip; all the lobes bright crimson-purple, with a violet reverse. B.R. 21:1796. B.M. 3336. L.B.C. 19:1872. Modified as described under var. *Youngeana*. R.H. 1851:261. F. 1850:137. The pictures cited above bear various legends which are not here repeated. The varietal names given above do not appear in the trade, the leading current names being *duplex* (hose-in-hose), *gloriosus*, *hybridus*, *hybridus tigrinus*, *hybridus tigrinus grandiflorus*, *quinquevulnerus maximus*, *tigridioides* and *tigrinus*. Some of these names are advertised as varieties, but all of them usually appear as if they were species. For *M. hybridus cupreus*, Hort., see *M. cupreus*.



1404. Forms of Mimulus luteus (× ⅓).

Var. **alpìnus**, Gray (*M. Rœzlii*, Hort.). About 2–12 in. high, leafy to the top: stem 1–4-fld.: corolla ¾–1⅛ in. long.

2. **cùpreus**, Regel (*M. lùteus*, var. *cùprea*, Hook.). A Chilean species, differing from *M. luteus* in its tufted habit and the fls. yellow at first, finally becoming copper-colored, and the lobes possibly rounder and more nearly equal, the throat yellow, spotted brown. B.M. 5478. Gn. 24, p. 177. R.H. 1883, p. 284.

3. **moschàtus**, Dougl. MUSK PLANT. Perennial, by creeping stems 1–3 ft. long: fls. pale yellow, lightly dotted and splashed with brown. B.C. to Calif. and Utah. B.R. 13:1118.—This and *M. luteus* have a broad throat. The fls. are normally about ¾ in. across, but in F.M. 1877:248 (var. *Harrisonii*) they are 1⅛ in. across. Hardy, evergreen trailer for damp, shady spots. Fine for planting under cool greenhouse benches.

4. **Léwisii**, Pursh. A more slender plant than the next, greener, and merely pubescent: lvs. minutely toothed: fls. rose-red or paler, the lobes all spreading. Shady, moist ground, B. C. to Calif. and Utah. B.M. 3353 and B.R. 19:1591 (both as *M. roseus*).

5. **cardinàlis,** Dougl. Villous: lvs. sharply toothed: fls. red and yellow, the upper lobes much grown together and reflexed, the whole limb remarkably oblique. Water-courses, Ore. and Calif. to Ariz. S.B.F.G. II. 358. B.M. 3560. R.H. 1857, p. 137. Mn. 8:161. F. 1843:193.—Hardy in Mass., with slight winter covering. Blooms first year from seed.

6. **glutinòsus,** Wendl. Two to 6 ft. high, nearly glabrous but sticky: fls. orange or salmon to pale buff, rather obscurely 2-lipped, the lobes toothed or notched. Rocky banks; common from San Francisco south. B.M. 354 (*M. aurantiacus*). A.G. 12:737. A.F. 12:1107.

7. **Clèvelandi,** T. S. Brandegee. Subshrubby, glandular pubescent: fls. golden yellow. G.F. 8:135.—Cult. only in S. Calif., where it is native. Not advertised.

8. **parviflòrus** (*Diplacus parviflòrus*, E. L. Greene). Rigidly shrubby, but flowering at from 3 in. to 2 ft. Glabrous and glutinous: lvs. narrowly ovate, coarsely serrate: corolla 1 in. long, nearly tubular; lobes quadrate, very little spreading. Santa Cruz Island, Calif.

9. **ringens,** Linn. Stem square: calyx teeth long and awl-shaped: fls. violet. Wet places, Canada to Iowa and Tex. B.M. 283. D. 251.

10. **alàtus,** Soland. Stem somewhat winged or angled: calyx teeth short and broad. Wet places, western New Eng. to Ill., south to Tex. L.B.C. 5:410. W. M.

MÍMUSOPS (Greek, *ape-like*, but application not obvious). *Sapotàceæ.* Tropical trees, with milky juice, of both hemispheres, of about 30 species. Lvs. thick and shining, simple and entire, alternate: fls. perfect, gamopetalous, the corolla of 6 or more lobes, but bearing twice as many appendages in the sinuses, the calyx of 6 or 8 sepals in two rows; stamens usually 6–8, inserted on the base of the corolla; staminodia present: fr. a globose, 1–6-seeded berry, sometimes edible. The Mimusops are fine evergreen trees, good for ornament in frostless countries, and yielding perfumery, rubber and other products. The fls. are small, white, and usually borne in axillary fascicles. Some of the species become more than 100 ft. high, and several of them yield hard and durable timber. A few species have been somewhat advertised in S. Calif. and S. Fla., but their culture in this country is of small account. The Sapodillo is a closely allied tree.

A. *Staminodia (or interior appendages) 2-toothed at the apex.*

globòsa, Gærtn. A large tree, yielding Balata rubber: lvs. obovate or oblong, 2–6 in. long, retuse or apiculate, grayish: calyx of 6 parts, canescent; corolla segments as long as the appendages in the sinuses: fr. often 2 in. in diam., globose. West Indies and Venezuela.

AA. *Staminodia entire or only subserrate.*

Sièberi, A. DC. Becoming 30 ft. tall: lvs. elliptic to obovate, retuse, green, 2–4 in. long, slender-petioled: corolla segments 6, oblong and exceeding the narrow appendages; fertile stamens 6; staminodia short-triangular, nearly entire: fr. nearly 1 in. in diam., brownish or yellowish, said to be edible. Key West to Trinidad.

Eléngi, Linn. Tall tree (becoming 50 ft.): lvs. elliptic and short-acuminate (3–3½ in. long), rhomboid at the base, petiole ¾ in. long: corolla lobes about 6, narrow-lanceolate; fertile stamens 8; staminodia pilose, acute, entire or nearly so: fr. 1 in. or less, ovoid, 1- or 2-seeded, yellow, edible. E. Ind.

dispar, N. E. Brown. Smaller tree than *M. Elengi:* lvs. small, cuneate-oblanceolate, obtuse, rusty-tomentose when young, but become glabrous-green, the petiole ⅓ in. or less long, and the blade ¾–2 in. long: fls. 12–16, in umbels on the tips of the branches: sepals 6–8, in two series: petals 18–24, in three series, linear-lanceolate, yellow: stamens 6–8: staminodia lanceolate-acuminate, channelled: fr. size of an olive, yellow. Natal.—Int. by Franceschi. L. H. B.

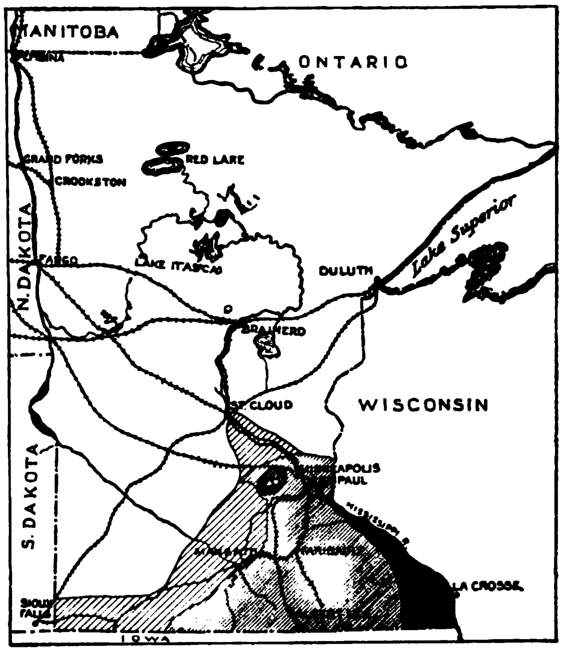
MINA lobata is *Ipomæa versicolor*. **M. sanguinea** is *I. coccinea*, var. *hederifolia*.

MINNESOTA, HORTICULTURAL STATUS OF. Fig. 1405. Minnesota has an area of 84,287 square miles. The surface is gently undulating, except in the extreme northwestern portion, where, in the Red River valley, are large, fertile, level prairies. Its roughest agricultural land is found in the eastern portion, along the Mississippi river, and in many places the bluffs reach a height of 400 feet above the valley. About one-half the state, embracing the northeastern and eastern parts, was originally heavily timbered, and much timber still remains in the northeastern portion, while many scattered groves of timber will be found elsewhere, especially along the rivers.

There are many lakes, the number of which has been estimated at 10,000. They are especially numerous in the central and northern portions, where they greatly modify the climate of lands in their vicinity. There are great variations of climate between the extreme northern half, where the summers are very short, and the southern half, where killing frosts seldom occur before the 1st of October. The winters are generally pleasant, but occasionally severe, and 40° below zero is sometimes experienced.

The soil is generally rich and well adapted to a variety of crops, but it is very variable, and there are some very extended areas in the northern part where there is much sandy land that should never be used for agriculture. The undulating surface, variety of good soil and vegetation, and abundance of lakes, afford many very picturesque and beautiful locations for successful horticulture.

Rainfall and Its Distribution.—The annual precipitation averages about 25 inches, and is well distributed during the growing season. The snowfall is light, and what falls remains usually during the winter. The spring is generally open early, and the transition from winter to spring is very rapid. The soil at St. Paul and southward can generally be worked by April 15, and frequently earlier. The summers and autumns are bright and sunny, and vegetation grows with great rapidity.



1405. Minnesota.
Horticultural areas, shown by degrees of shading

Currants, gooseberries, raspberries, blackberries, strawberries, juneberries, Americana plums, and the frost or river-bank grape are native fruits that are found wild in abundance in favorable locations throughout the state. Most of the well-known cultivated sorts of the five species first named do well under cultivation, and large quantities are raised for home consumption and are profitably marketed. The Concord, Worden, Delaware, and grapes of similar character, are easily raised in the many good locations along the lake shores and the river bluffs, and this is an important industry notwithstanding the fact that they have to be covered in winter, which adds somewhat to the expense of culture. However, on account of the peculiar adaptability of the Delaware grape to some of our soils and to the climate, it is raised with profit in competition with the growers of the eastern states, though the Concord is not high enough in price by one cent a pound to permit of this to any great extent.

Apples are raised on a commercial scale in southern and eastern Minnesota, the high, rolling land in the southeastern portion being especially well adapted to their cultivation. The varieties of the eastern and central states generally prove a failure here. The Duchess of Oldenburg is the standard of hardiness in apples, and can be grown successfully in good locations as far north as St. Paul, and in a small way 100 miles further north. The Talman Sweet is raised to some extent, but is liable to suffer in severe winters. The Minnesota seedling apple known as the Wealthy is generally the most profitable kind grown. (See *Gideon*, p. 642.) Much interest centers around the introduction of varieties of apples of unusual hardiness, and a few of the Russian sorts are proving very satisfactory. The hardiest variety of this origin so far found is the Hibernal, which represents a class of sour autumn apples that will thrive on suitable soil in almost any portion of the state. The Charlamoff is another very hardy early autumn apple of the same class. Such hybrid crabs as the Transcendent, Martha, Gideon No. 6 and Minnesota may be successfully grown in suitable locations and soil over most of the state.

The Americana class of plums is found growing wild all over the state, and the fruit is gathered in large quantities. The cultivated sorts of this class are easily grown everywhere. Wild plums can generally be obtained in abundance in autumn at about $1.50 per bushel. There is no variety of any other class of plums that is appreciably cultivated, although in very favorable locations a few of the Japan and domestic sorts are generally grown.

Cherries may be successfully grown on a large scale in extreme southeastern Minnesota, and there are some commercial orchards; there but generally throughout the state the fruit buds are so injured in winter that the trees are unproductive, although they may make a very satisfactory tree growth.

Pears generally blight to death early, and there is no variety that is generally cultivated. Several of the Russian pears are as hardy as the Duchess apple, but they have died, so far as tried, from blight before becoming very productive. Apricots are not sufficiently hardy.

The most common injury to trees is known as sunscald of the trunks, which often causes severe loss. It is easily avoided by shading the trunks. Blight seriously injures some varieties of apples. Winter protection of various kinds is important and carefully attended to by our best horticulturists.

Vegetables of all the kinds grown in the northern states are very easily raised, and the display of these products in the large markets is very excellent. Cabbage, cauliflower, celery, peas, lettuce, potatoes, beans, corn, cucumbers, tomatoes, squash, watermelons, muskmelons and eggplant are to be had in abundance, and the markets are often glutted with them. Native muskmelons and tomatoes occasionally retail at 10 to 15 cts. per bushel. The canning of vegetables is becoming an important industry at several points. The climate seems to be especially favorable to vegetables, and there is much less trouble from diseases than in many more humid sections.

The demand for ornamental horticulture is considerable and rapidly increasing, giving investment to perhaps $200,000 in the greenhouse business, and adds no small sum to the receipts of the several large and the many small nurseries in the state. The love for horticulture is also shown by the immense sums spent by the cities and small towns for public parks. St. Paul and Minneapolis together have upwards of 3,000 acres in their public parks, which are well cared for, very beautiful, and visited by at least two million persons each year.

The Minnesota State Horticultural Society is a very strong and popular organization, having a membership list of about 800, each of whom pay an annual membership fee of $1. It publishes, at the expense of the state, a monthly journal and an annual report. It also receives aid from the state to the amount of $1,500 annually. It has recently offered $1,000 for a seedling winter apple especially adapted to Minnesota conditions. Great interest is taken in the raising of seedling apples, and at some of the state fair meetings more than 300 separate varieties of Minnesota origin have been shown.

The state experiment station is located near St. Paul and pays considerable attention to horticulture. It has four sub-experiment stations, located in various parts of the state. One of these is located at Owatonna, and is devoted almost exclusively to the raising of seedling apples. The Agricultural Department of the university had over five hundred in attendance in the school year of 1899–1900. Four hundred of these attended the agricultural high school, where, in addition to the other agricultural studies, much attention is paid to horticulture and forestry.

SAMUEL B. GREEN.

1406. Four-O'Clock—Mirabilis Jalapa.
Nearly natural size.

MINT. See *Mentha*.

MINT GERANIUM. *Chrysanthemum Balsamita*, var. *tanacetoides*.

MIRÁBILIS (*Admirabilis*, meaning wonderful, strange; shortened by Linnæus to Mirabilis). *Nyctaginaceæ*. About 10 species of the warmer parts of America, 4 of which are cultivated for their pretty or showy fls The fls. have no corolla, but the calyx is colored and tubular and exactly like a corolla in appearance. The fls. are surrounded by a leafy involucre, and sometimes (as in *M. Jalapa*) only one flower is borne in an involucre simulating a corolla in a 5-cleft calyx. The stamens are 5 or 6, as long as the perianth, their filaments united at the base. Style 1, with a capitate stigma. Fruit hardened, capsule-like and indehiscent. They are perennial herbs, although grown as annuals from seeds, with lvs. petioled and opposite, and fls. solitary or paniculate and nearly or quite sessile in the involucres.

A. *Involucre containing only one flower: plant glabrous or very nearly so.*

Jalápa, Linn. FOUR-O'CLOCK. MARVEL OF PERU. Fig. 1406. Erect-bushy, quick-growing herb, germinating readily from the large, conical-oblong fruits, 2–3 ft. high, bearing profusely in late summer and fall long-tubed funnelform fls. in white and shades of red and yellow, and striped, opening in cloudy weather or late in the afternoon (whence the common name Four-O'Clock), and closing in the morning. Lvs. ovate-lanceolate, short-petioled, acuminate, entire: fls. in clusters amongst the lvs.; stamens not exserted. Tropical Amer. B M. 371.—Cultivated from early times, and always a favorite. In tropics it has tuberous roots, and these were once supposed to be the source of Jalap, whence the name *Jalapa*. There are dwarf and compact varieties; also forms with variegated foliage. The Four-O'Clock is an "old-fashioned flower." It is treated as a tender annual. Thrives in any garden soil. A useful plant for growing in a hedge (plants 1 ft. apart) at the rear of the flower-garden. It sometimes comes up in the spring from self-sown seeds. Even as far north as New York, it often produces tuberous roots large enough to be lifted and stored like dahlias.

AA. *Involucre containing 1–3 fls.: plant viscid-pubescent.*

Califórnica, Gray. Plant 1–3 ft. tall, yellowish green, the many stems ascending from a somewhat woody base: lvs. thick or almost fleshy, ovate-oblong to round-ovate, short-stalked: involucres 5-cleft, short-peduncled, containing 1–3 rose-purple fls. a half-inch long, with stamens sometimes protruded. S. Calif. to Utah and S.—Little known in cultivation.

AAA. *Involucre containing 3 or more long-tubed fls.*

multiflòra, Gray. Stout and tall (2–3 ft.), much-branched, somewhat pubescent or sometimes glabrous: lvs. rather thin, gray-green, lance-ovate to broad-ovate, more or less cordate, short-stalked, acute or acuminate: involucre ⅛ in. long, stalked: fls. 6, with a tube often 2 in. long, rose to purple, the style and the 5 stamens protruded.—Var. **pubéscens,** Wats. (*M. Frœbelii*, Greene), is very pubescent throughout. The *M. multiflora* of B.M. 6266 is probably this variety. The species ranges from Colo. to S. Calif. and S. Little known in cult.

longiflòra, Linn. Plant 2–3 ft., glandular-pubescent above: lvs. cordate and usually acuminate, short-stalked, pubescent: fls. pubescent, with a very narrow tube 5–6 in. long, and a small, flaring white, rose or violet limb, very fragrant at evening. Mexico.—An old garden plant, but less frequent than *M. Jalapa*. Easily grown from seeds. It has been hybridized with *M. Jalapa*.

L. H. B.

MISCÁNTHUS (Greek, *miskos*, a stem, and *anthos*, a flower). *Gramineæ*. EULALIA. Comprises about 6 species in southern and eastern Asia, several of which are cultivated for ornament. Tall perennial grasses with ample terminal fan-shaped panicles, allied to the sugar cane and Erianthus. Includes the Eulalias of the trade but not Eulalia, Kunth, which is referred to Pollinia, Trin., by Hackel. Spikelets 1-fld., in pairs at the joints of the rachis, one nearly sessile, the other pedicellate, usually awned. Glumes 4. A cluster of silky hairs arises from the base of the spikelets, which gives the panicle its beautiful feathery appearance. Increased by seed or division of roots.

Although many progressive nurserymen now advertise these favorite grasses as Miscanthus, the name Eulalia will probably remain in the English language as a thoroughly naturalized word, like Geranium and Chrysanthemum. Eulalias probably rank among the first half dozen most popular grasses cultivated for ornament. They are remarkably hardy and are universal favorites for bedding. One of the commonest and best designs for a bed of ornamental grasses employs *Arundo Donax* as a tall center piece, surrounded by Eulalias.

1407. Miscanthus Sinensis.

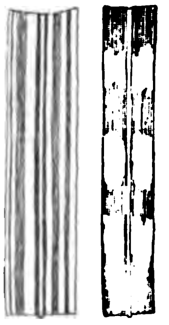
Which, under the name of Eulalia, is one of the most popular of ornamental grasses.

saccharífer, Benth. (sometimes written *sacchariflòrus*). Distinguished by its nearly or quite awnless spikelets. China. Gt. 1862:357.—Procurable of dealers in Japanese plants.

Nepalénsis, Hack. HIMALAYA FAIRY GRASS. Spikelets one-fourth as long as the brown involucral hairs. Lvs. smooth on the margin. Occasionally cultivated. Himalayas.

Sinénsis, Anders. (*Eulàlia Japónica*, Trin.). Figs. 1407, 1408. Spikelets about equaling the white or sub-violet involucral hairs. Culm 4–9 ft.: lvs. 2–3 ft., margins scabrous: panicle 6–12 in., formed late in the season. Established plants form clumps as much as 18 ft. in circumference. The forms in cultivation are mostly the following varieties: Var. **variegàtus,** with leaves striped; **zebrinus,** leaves banded. These two varieties are not quite so hardy as the type, and are usually propagated by division, as the seeds are not so sure to come true. Gng. 4:375; 6:107. B.M. 7304. Var. **gracillimus** (*Eulàlia gracillima univittàta*, *E. Japónica gracillima*, etc.). Leaves much narrower than the type. Gn. 50, p. 108. Gng. 5:273. R.B. 21, p. 179.

A. S. HITCHCOCK.

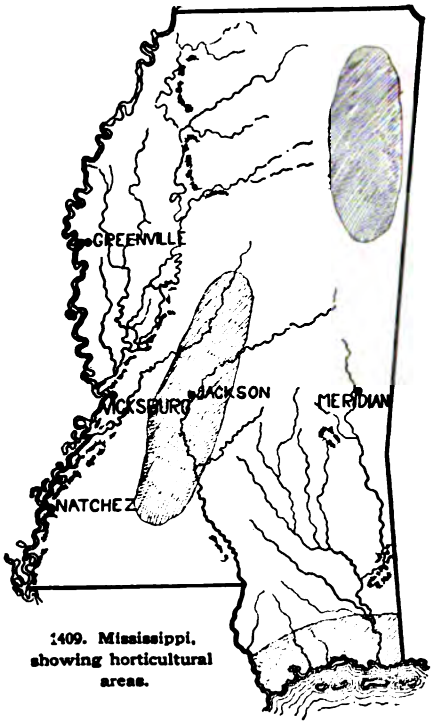


1408. Variegation in Miscanthus Sinensis.

At the left, *variegatus*; middle, *zebrinus*; right, *gracillimus*.

MISSISSIPPI, HORTICULTURE IN. Fig. 1409. Mississippi extends about 325 miles from north to south and 175 miles from east to west. The surface is mostly undulating, with few abrupt hills, and the highest part of the state, the northeastern section, is less than 1,000 feet above the sea level. It has an annual rainfall of about

45 inches in the northern part, the amount increasing to about 60 inches in the extreme south. The winter temperature is rarely as low as zero in any portion of the state, while the extreme summer heat rarely reaches 100° in the northern part; while near the Gulf coast 95° is the usual limit. The first frosts usually occur in November, and spring frosts are rare after the middle of March. The soil is extremely variable. The western portion of the state, known as the Yazoo Delta, has one of the richest alluvial soils in the world, and one well suited for the growing of vegetables. The north-central part of the state consists largely of yellow clay hills, not very fertile and liable to serious injury from erosion, but with very fertile valleys between them, while the northeastern section has a strong lime soil which is very productive. Nearly all of the southern half of the state has a sandy loam soil underlaid with clay at a depth of a few inches, making those lands among the most desirable for the cultivation of either fruits or vegetables.



1409. Mississippi, showing horticultural areas.

Although both fruits and vegetables are grown for export in all parts of the state, there are three districts in which horticultural work is specially prominent. These are (Fig. 1409):

1. The northeastern district, covering the territory along the Mobile and Ohio railroad from Booneville south to West Point.
2. The central district, covering the territory along the Illinois Central railroad from Durant south to Brookhaven.
3. The Gulf coast district, covering the territory along the Louisville and Nashville railroad from Bay St. Louis east to Orange Grove.

Peaches are grown more extensively than any other fruit, and are shipped to northern markets from nearly or quite every county in the state. The long growing season enables the trees to come into bearing rapidly, and a small crop of fruit is usually gathered the second year from planting, while the trees often continue fruitful from 15 to 20 years. Although the trees themselves are never injured by cold, the fruit crop is occasionally cut short by spring frosts following warm winter weather, which sometimes brings the trees into bloom before the end of January. The early fruit is ready for market about the last of May, and shipments continue from that time until August, or later. Elberta, Mountain Rose, Georgia Belle, Lilly Miller and Chinese Cling are among the more popular varieties.

Pears grow well in all parts of the state, and, until about 1895, were planted more widely than any other fruit trees, but since that time the blight has been so widespread and so severe that very few new orchards have been planted. Fully nine-tenths of the trees are either Le Conte or Kieffer, the latter being the more resistant to blight.

Apple trees make a fair growth and bear well for some years, but become less vigorous with age, and are shorter lived than in more northern latitudes. Nearly all varieties ripen during the summer and fall, and very few, even of the "long keepers," can be preserved through the winter. The fruit always commands a high price in the local markets, which makes the trees profitable, even though they last but a few years. Considerable fruit, mostly Early Harvest and Red June, is shipped from the northeastern district, but no other part of the state produces enough for a home supply.

Plum trees are of uncertain value. The Wild Goose and the Japanese varieties are the more common sorts, and while some trees and some orchards may grow well and bear heavily for many years, the majority succumb after producing two or three crops. Cherries are rarely successful. Figs are grown quite commonly for home use in the central part of the state, and in the Gulf coast district are an important market crop. The fig does not succeed under orchard conditions, but a few trees grown near the house do well, and many of the older trees produce 1,000 pounds or more of fruit annually, and this finds a ready market at the canning factories. The Celeste is the common variety, and the demand for the fruit at 4 cents per pound is far in excess of the supply. Oranges are grown along the Gulf coast, but even there the winters are occasionally so cold as to make them unprofitable.

Among the small fruits strawberries are the most important, being grown by thousands of acres. They are grown more extensively in the central district than elsewhere, though there is a considerable acreage in the northeastern district also. In the Gulf coast district the plants grow well and bear abundantly, but the fruit grown there is usually softer and less desirable for shipping than that grown in drier localities. Bubach, Crescent, Gandy, Warfield and Michel are the favorite varieties. Shipments begin about the first of April, and the bulk of the crop is gathered during the next six weeks, though occasional shipments are made during every month of the year.

Grapes grow and bear as well as it is possible for them to do in any part of the country. The long season for growth develops very strong vines which are never injured by the cold of winter, and the latest ripening sorts have ample time for maturing. The early varieties ripen about June 20 in the Gulf coast district, and about July 10 in the northeastern district, and nearly all the crop is gathered by August 1. This early ripening of the fruit enables the grower to secure high prices for his early shipments, but a crop which matures in the heat of midsummer cannot be kept profitably, even in cold storage, but must be marketed at once, regardless of price. Champion, Ives, Delaware, Niagara, Perkins and Herbemont are among the more popular varieties. The Scuppernong (*Vitis rotundifolia*) is a valuable native species which is grown in all parts of the state for home use and for the manufacture of wine, but is not a shipping variety.

Blackberries and dewberries grow spontaneously in all parts of the state and have proved quite profitable in cultivation, the Lucretia, Dallas and other hybrids being the favorite varieties. Neither currants nor gooseberries do well in any part of the state, as they make a new growth and come into bloom soon after the fall rains begin, and soon become so weakened as to be worthless. Raspberries do well when planted on soils containing sufficient moisture, but are seldom grown for market excepting in the northeastern district. Turner is the favorite variety, and the blackcaps are rarely seen.

The growing of early vegetables for northern market is followed more extensively and is more generally profitable than is the growing of fruits. Field plantings of radishes, peas and other hardy sorts begin in January. Shipments begin by the first of March and continue until the melon crop is harvested in July. The first crop of Irish potatoes, mostly Early Ohio and Triumph, is ready for market in May, and in August a second crop is often planted which matures in November, when it finds a ready home market, or is left in the ground until early spring, when it is placed on the northern markets as "new potatoes just received from Bermuda," and brings a high price. This second crop, however, is uncertain, as it is difficult to secure a prompt growth if seed from the early crop is used, and it is often impossible to secure northern seed so late in the season. Sweet potatoes are grown in all parts of the state, and are shipped from July until March. Asparagus is a profitable early crop which is grown quite largely in the central district, and seems wholly free from rust or other diseases. Rhubarb is unable to endure the heat of the long summer, and the roots soon decay. Beans, beets, cabbages, peas, radishes and turnips are all grown so largely as to be shipped in car-load lots from a number of towns in the northeastern and central districts. The crop grown more widely than any other is the tomato, which is grown in all parts of the state, and which is shipped by the car-load to all parts of the country from Boston to St. Paul, Omaha and Denver. Many single growers ship by car-lots, and in June from 10 to 20 cars are shipped daily from Crystal Springs, with nearly as many from Madison Station and Booneville, besides smaller shipments from many other points.

From the central district, shipments are made about as follows:

Beans, May 10 to June 10.
Beets, April 20 to June 15.
Cabbage, May 1 to June 5.
Carrots, April 20 to June 10.
Melons (Gem), June 20 to July 20.
Peaches, June 1 to August 1.
Peas, March 25 to April 25.
Potatoes, Irish, May 10 to June 15.
Radishes, March 1 to April 15.
Squash, Summer, May 15 to June 15.
Strawberries, April 1 to May 10.
Turnips, March 20 to May 15.
Tomatoes, May 25 to July 4.
Watermelons, July 1 to August 1.

There are a number of canneries in the state, the most successful being those at Booneville and Biloxi, but ordinarily growers find it more profitable to ship products to northern markets than to sell at prices which canners can afford.

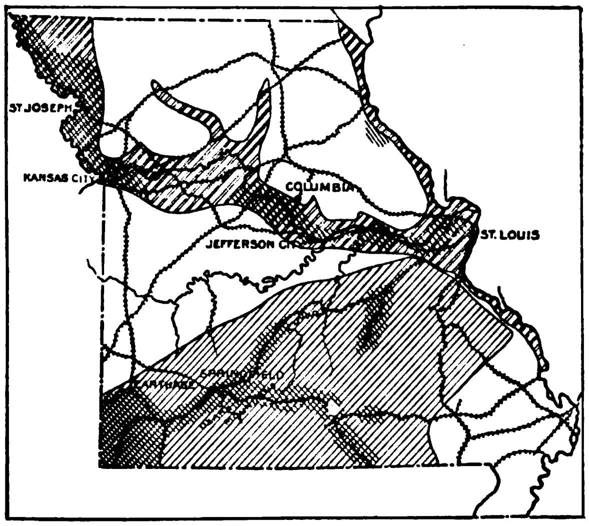
No statistics are available on which definite statements of the total shipments from the state can be based. Crystal Springs, in the central district, probably ships more than any other single point. The shipments of fruits and vegetables from that place amounted to 638 cars in 1898, while in the very unfavorable season of 1899 the number fell to about 400. Partial reports from other points indicate that shipments, in car-lots, amount to not less than 5,000 cars annually, in addition to nearly as much more which is shipped in small lots. The northeastern and central districts ship principally to northern markets, while the Gulf coast district finds its markets in Mobile, New Orleans, and on the many foreign vessels loading in Ship Island harbor. Nearly the entire business has been developed in the last 15 years, and each succeeding year shows a marked increase in its volume. New localities are being opened, the work is becoming better organized, and, with the increase of the business the markets are becoming more steady, prices more uniform, and the profits more satisfactory than in the early days. The business has by no means reached its full development, and will not do so for years to come.

S. M. Tracy.

MISSOURI HORTICULTURE. Fig. 1410. Its central position gives Missouri a medium climate, favorable to the growth of a variety of horticultural products. The native flora embraces both northern and southern plants. The wild American crab and the Juneberry, capable of enduring the rigors of a northern winter, flourish here in the same forests with the more southern persimmon and papaw. The northern grapes of the Labrusca type, like Concord, are among the standard varieties, while on the other hand, the more tender *Vitis rotundifolia*, of which the southern Scuppernong is the most familiar cultivated sort, grows wild in the rich river bottoms. While the berries and small fruits common to the northern states endure well the warmer climate of Missouri, the oriental persimmon and English walnut are hardy as far north as the central part of the state.

Missouri's central position is also favorable to the marketing of her fruit. Berries and peaches are sent to nearly all the principal markets east of the Rocky mountains from Boston and Baltimore on the east to Omaha, Denver and Pueblo on the west, and from St. Paul and Detroit on the north to Mobile, New Orleans and Galveston on the south. The grain-raising, mining and grazing states to the west and northwest, where but little fruit is produced, furnish a growing market for Missouri fruit. The Mississippi and Missouri rivers, touching the entire length and breadth of the state, give cheap freight rates north, south and northwest, while direct railroad connection with the Gulf ports affords cheap shipments of apples to European markets.

The following figures give the average monthly rainfall in inches for the past six years, recorded at Columbia by the U. S. Weather Bureau:



1410. Missouri.

The diagonal shading in the southern half designates the Ozark uplift. The double-line shading along the Mississippi and Missouri rivers shows the loess formation. The short-line cross-shading designates the parts where fruit-growing is much developed.

Jan., 1.89; Feb., 2.57; March, 2.97; April, 4.52; May, 5.87; June, 4.56; July, 4.85; Aug., 2.81; Sept., 3.60; Oct., 1.40; Nov., 2.87; Dec., 2.02.

While these figures show that the rainfall is ample, and well distributed throughout the year, the records also show that the percentage of sunny days in this immediate section is high. During August, September and October especially, when most of our fruit is maturing, the average amount of bright sunlight is considerably higher than that of the majority of our orchard states. No doubt the intense sunlight and proximity to the airy prairies are important factors in producing the rich color and high flavor of Missouri fruit, and may also account, in part, at least, for its comparative freedom from many of the fungous diseases which are known to thrive best in a moist, cloudy atmosphere.

The topography and soil of the state are both favorable to fruit-growing. The undulating areas, intersected by the Mississippi and Missouri rivers and their tributaries, are amply provided with both soil and atmospheric drainage. The soil varies from the light, deep flinty soil of the Ozarks, and the drift of the "loess" formation (see *Iowa*), to the rich soil of the prairie openings and still heavier soils of the river bottoms, and the swamp lands to the southeast, affording choice for different purposes. The immense crops of corn and garden vegetables, sometimes grown in young orchards, and the clover and cow peas, grown to prevent washing of the soil in steep hillside orchards, prove (perhaps too frequently), that even the so-called "fruit lands" are capable of yielding a great variety of products. In fact, one great reason why Missouri has not earlier taken front rank as a fruit state is because natural conditions for general agriculture are too favorable. It requires too great an effort to exclude the encroaching blue grass and live stock from orchard areas where thrifty young trees fruit themselves to death in the unequal struggle for existence and the reproduction of their kind.

1411. Ben Davis (X ⅓).
One of the "big red apples" of the Ozarks.

The last report of the Missouri State Horticultural Society (1897) contains Secretary Goodman's estimate of the quantity and value of fruit produced in the state that year, as follows: Apples—north Missouri, 2,500,000 barrels; central Missouri, 3,500,000; south Missouri, 3,000,000; total value of apples, $12,000,000. Peaches—north Missouri, 500,000 bushels; central Missouri, 1,000,000; south Missouri, 2,000,000; total value of peaches, $3,500,000. Total value of berries, $2,500,000. Total value of pears, cherries, plums and grapes, $1,500,000. These, with nuts and miscellaneous fruits, reach a total value of $20,000,000 for the Missouri fruit crop for 1897. This report is based upon figures obtained from the various railroads and shippers, and may be relied upon as being approximately correct. Considering the fact that a few years ago Missouri could hardly lay claim to being a great fruit-producing state, the above figures indicate very rapid growth of the industry in recent years. In 1898 more young trees were planted than in any previous year, showing an accelerating tendency toward this line of business. A number of orchards in the state comprise over one thousand acres each. The size and number of these large orchards is annually being increased.

It will be seen that the apple is the leading fruit, exceeding in value all other kinds combined. Careful study shows that other things being equal, the best prices prevail in those parts of the state where the most apples are grown, and where, consequently, there is the sharpest competition among buyers. The peach ranks second in importance, and the berries third. The city of Sarcoxie shipped 239 car-loads of strawberries in 1897, and now 1,500 acres of strawberries are growing in its immediate vicinity. Liberal is one of the largest blackberry centers. Hermann and several points in the Ozarks manufacture large quantities of grape wine.

Aside from the work of the Agricultural College and Experiment Station in the promulgation of horticultural work, the Missouri Botanical Garden at St. Louis, being of international influence and importance, cannot fail, with its splendid equipment and able management, to lend an especially strengthening influence to the horticulture of the state in which it is located. The Missouri State Horticultural Society, with nearly one hundred local societies as auxiliaries, under the competent leadership of its officers and organized effort of its members, is doing much toward the development of horticulture.

While horticulture is already one of the leading interests of Missouri, the possibilities of the state in that direction have not yet even been approached. Only a small portion of the soil naturally well adapted to fruit culture has ever been cultivated, and there are many phases of horticulture that have not been developed. In recent years, however, steps in advance are rapidly being taken. The best growers no longer cling to ancient traditions and obsolete practices, but are evolving methods adapted to the new conditions of the West. Capitalists of extensive business training are investing in orchards, and their business ability, combined with the skill of the practical grower, is resulting in better marketing and general management of the industry. New varieties, better adapted to local conditions, are being originated. Our native fruits and nuts are receiving attention, and improved varieties of these are already the result. The working up of surplus and inferior fruit by canning, evaporating, cider and winemaking and distilling is increasing the value of the fruit product, and the canning of tomatoes, peas and other garden vegetables is quite extensively carried on in some sections. In fact, the horticulture of the state is in a rapidly growing condition, and bids fair to reach very important proportions. J. C. WHITTEN.

MISTLETOE of the Old World is *Viscum album;* of America, *Phoradendron flavescens.*

MITCHÉLLA (Dr. John Mitchell, of Virginia, one of the first American botanists; correspondent of Linnæus). *Rubiàceæ.* This includes the Partridge-berry, one of the prettiest and hardiest of native perennial trailers. It has small, shining, evergreen, roundish lvs., sometimes marked with white lines, and bright scarlet berries, often borne in pairs, which remain all winter and make a charming effect when peeping through the snow. This plant can be easily collected, and is also procurable from many dealers in hardy plants. It thrives under evergreen trees, forming dense mats. The fls., which are borne in spring, are small, white, with pinkish throats, and are fragrant. The berries are edible, but nearly tasteless. Fls. twin, the ovaries united into one; calyx 4-toothed; corolla funnel-shaped, 4-lobed; lobes spreading, densely bearded inside, valvate in the bud: fr. a 2-eyed berry.

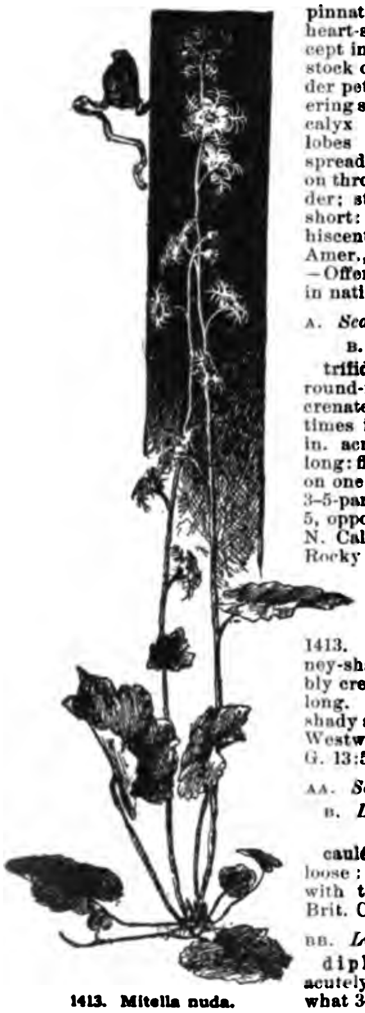
1412. Partridge-berry—Mitchella repens (X ¼).

rèpens, Linn. PARTRIDGE-BERRY. SQUAW-BERRY. Fig. 1412. Lvs. opposite, round-ovate, petioled, with minute stipules: fls. in pairs, on the apex of a peduncle. Nova Scotia to Minn., south to Fla. and Tex. G. W. F. 42. D. 81. Mn. 3:49. L. B. C. 10:979.—Attractive in half-shaded spots in the wild garden and rockeries. Propagated by division of roots.

M. ovàta, DC., from Ecuador, is the only other species. It has solitary, sessile fls., and ovate, acutish lvs. Not cult.

M. B. COULSTON.

MITÉLLA (diminutive of *mitra*, a cap; applied to the form of the young pod). *Saxifragàceæ.* MITREWORT. BISHOP'S-CAP. Six or 7 species of low, slender perennials, with somewhat creeping rootstocks and racemes of small and greenish or white fls. Closely related to Tiarella, but the petals of the latter are entire, while in Mitella they are beautifully pinnatifid. Lvs. round, heart-shaped, alternate, except in one species, on rootstock or runners, with slender petioles; those on flowering stems opposite, if any. calyx short, 5-lobed, the lobes valvate in the bud, spreading; petals 5, inserted on throat of calyx, very slender; stamens 10 or 5, very short: fr. soon widely dehiscent. Natives of N. Amer., 2 species in E. Asia. —Offered by some dealers in native plants.



1413. Mitella nuda. Nearly natural size.

A. *Scapes usually leafless.*

B. *Fls. numerous.*

trifida, Graham. Lvs. round-reniform or cordate, crenately toothed and sometimes incised or lobed, 1–3 in. across: scape 9–12 in. long: fls. somewhat scattered on one side of spike; petals 3–5-parted, small; stamens 5, opposite the calyx lobes. N. Calif. to Brit. Col. and Rocky Mts.

BB. *Fls. few (about 5).*

nùda, Linn. Fig. 1413. Lvs. rounded or kidney-shaped, deeply and doubly crenate: raceme 4–6 in. long. Does well in moist shady situations. May–July. Westward to Brit. Col. A. G. 13:518.

AA. *Scapes bearing leaves.*

B. *Lvs. on scape alternate.*

caulèscens, Nutt. Raceme loose: stamens alternate with the pinnatifid petals. Brit. Col. to Ore.

BB. *Lvs. on scape opposite.*

diphýlla, Linn. Lvs. acutely heart-shaped, somewhat 3–5-lobed, toothed: raceme 6–8 in. long. May. Eastern U. S. V. 12:189.—A good plant for the rockery.

M. B. COULSTON.

MITREWORT. *Mitella.* **False Mitrewort** is *Tiarella.*

MITRIOSTÍGMA (Greek, *mitre-shaped stigma*; from the conspicuous stigma, which is club-shaped, the 2-cut summit suggesting a cap). *Rubiàceæ.* This includes the charming evergreen tender shrub known to the trade as *Gardenia citriodora.* It makes a low or medium-sized bush of compact and branching habit and bears a great profusion of fls. which resemble those of the orange in odor, size, color and general appearance. The fls. are white, salver-shaped, 5-lobed, tipped with pink in the bud, and borne in dense axillary clusters. This delightful plant is a favorite in the South, together with the Cape Jessamine, but is little known in northern conservatories. The genus contains 2 species. For distinctions from Gardenia and Randia, see *Gardenia.*

axillàre, Hochst. (*Gardènia citriodòra*, Hook.). Lvs. opposite, petiolate, elliptic-lanceolate, subacuminate, glabrous; stipules awl-shaped from a broad base: calyx not ribbed, lobes lanceolate, acuminate, equal: corolla tube twice as long as the calyx, lobes obovate, obtuse. S. Afr. B.M. 4987. R.H. 1859, p. 175; 1886:348 (excellent!). F.S. 12:1254.

W. M.

M'MAHON. See p. 963.

MOCCASIN FLOWER. North American name for species of *Cypripedium.*

MOCK ORANGE. See *Philadelphus.*

MÒHRIA (from Daniel Mohr, a German botanist; died 1808). *Schizæàceæ.* A genus of South African ferns, having the habit of Cheilanthes, but the sporangia of the Schizæaceæ. A single species, *M. caffròrum*, is rare in cultivation in America.

L. M. UNDERWOOD.

MOLE PLANT. *Euphorbia Lathyris* (see Fig. 800, p. 564).

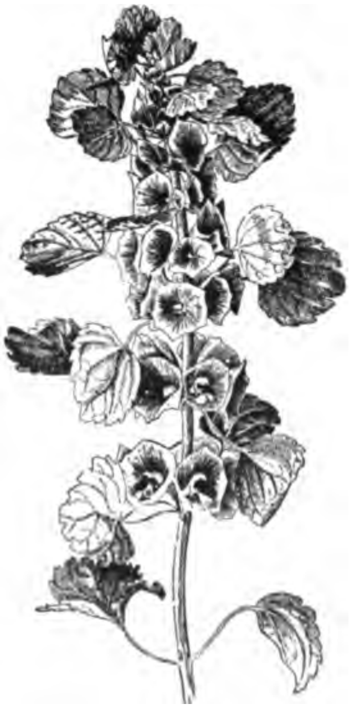
MOLÌNIA (J. Molina, a writer upon Chilean plants). *Gramineæ.* A genus of perennial grasses allied to Eragrostis, containing a single species. Native of central Europe and temperate Asia, and sparingly introduced in the United States. Panicle contracted: spikelets 2–4-fld., more or less purplish: glumes somewhat unequal: fl.-glume 3-nerved, rounded on back, pointed but awnless.

cærùlea, Moench (*Aira cærùlea*, Linn.). Culms tufted, 1–3 ft. high: lvs. rather rigid, slender pointed. The usual form in cult. is var. **variegàta**, with striped lvs., used for bedding.

A. S. HITCHCOCK.

MOLUCCA BALM. *Moluccella lævis.*

MOLUCCÈLLA (diminutive made from Molucca). Also written *Mollucella.* *Labiàtæ.* This includes the Shell Flower, a quaint old annual plant, that self-sows in old-fashioned gardens, but is now rarely advertised for sale. Its chief feature is its great cup-shaped calyx an inch long, which is much larger than the inconspicuous corolla (See Fig. 1414.) Later four white seeds or



1414. Moluccella lævis (×⅓).

nutlets appear in the cup or shell-like calyx, and add to the interest. The corollas are gaping, the upper lip forming a sort of hood, which may be notched or not, the lower lip 3-cut, the side lobes being oblong and somewhat erect, the middle one larger, inversely heart-shaped and deeply notched. Of 25 described names only 2 now remain in this genus as good species. Bentham & Hooker place this genus near Lamium. Other genera of garden value in which the upper lip of the corolla is concave or vaulted and often villous within are Stachys, Leonurus and Phlomis. From these Moluccella is easily distinguished by its calyx. These plants are hardy annuals, flowering in midsummer. The fls. are white, tipped pink, scarcely, if at all, thrust out of the calyx, and borne in whorls of 6–10.

A. *Calyx not prickly.*

lævis, Linn. SHELL FLOWER. MOLUCCA BALM. Fig. 1414. Height 2–3 ft.: lvs. roundish, with coarse round teeth: calyx obscurely 5-angled. W. Asia. B.M. 1852. —Fls. odorous.

AA. *Calyx beset with long prickles.*

spinòsa, Linn. Height 6–8 ft.: lvs. ovate, deeply and sharply cut: calyx with 1 long spine above and 7 others below. S. Eu., Syria. B.R. 15:1244 (as *Chasmonia incisa*).—Annual or biennial, with brownish red square stems, bristling calyx and gaping corolla. Said to have been cult. in Eng. since 1596.

W. M.

MOMÓRDICA (*mordeo*, to bite, since the seeds appear to have been bitten). *Cucurbitàceæ.* There are 25 species of Momordica, chiefly African, according to Cogniaux (DC. Monogr. Phaner. 3). They are annual or perennial tendril-climbing herbs of tropical countries, some of which are cult. for ornament and also for the edible fruits. The fls. are monœcious or diœcious, the staminate solitary or panicled, the pistillate solitary. Corolla and calyx similar in sterile and fertile fls.: corolla segments 5, often extending nearly to the base, making a rotate or broadly campanulate flower; stamens usually 3, the short filaments free, one of the anthers 1-loculed and the others 2-loculed: style single and long, with 3 stigmas: fr. oblong or nearly spherical, small, often rough, usually many-seeded, sometimes splitting into 3 valves, but usually indehiscent: seeds usually flattened, often oddly marked or sculptured. Tendrils simple—in this distinguished from Luffa. Momordicas are known to American gardens as ornamental vines, but the fruits of *M. Charantia* are eaten by the American Chinese. They are tender annuals. They thrive where cucumbers and gourds will. *M. Elaterium* of the catalogues is Ecballium, which see.

A. *Bract about midway on the peduncle, entire: all peduncles bracted.*

Charántia, Linn. BALSAM PEAR. Running 10 ft. or more, the stem slightly pubescent and furrowed: lvs. roundish, dull green, pubescent beneath (at least on the ribs), 5–7 lobes with rounded sinuses, the lobes sharp-toothed and notched: fls. yellow, 1 in. across, both the sterile and fertile solitary: fr. yellowish, oblong, pointed, furrowed lengthwise and tuberculate, 6 or 7 in. long, at maturity splitting into 3 divisions and disclosing the bright scarlet arils of the white or brown carved seeds. Trop. Asia and Africa, and naturalized in W. Indies. B. M. 2455. A. G. 13:525. R. H. 1869, pp. 630–1.—The Chinese about the American cities grow this plant under the name of La-kwa, for the edible pulpy arils surrounding the seeds, and also for the edible fruit itself (which is prepared, usually by boiling, before it is ripe). The rind is sometimes dried and used in medicinal preparations (see Bailey, Bull. 67, Cornell Exp. Sta., with illustr.). The odd seeds cause it to be called the "Art Pumpkin" by some.

AA. *Bract of sterile peduncle near the top, toothed: peduncle of fertile flower bracted at base or not at all.*

Balsámina, Linn. BALSAM APPLE. Slenderer and more graceful, bright green throughout, glabrous, the foliage smaller and neater: lvs. cordate-orbicular in outline, 3 in. or less across, 3–5-lobed, with rounded sinuses, the lobes and the few notches or teeth acute: fls. solitary, nearly or quite 1 in. across, yellow, often with blackish center: fr. orange, 2–3 in. long, ovoid and more or less narrowed each way, smooth or tuberculate: seeds compressed, nearly smooth. Widely distributed in Africa and Asia, and naturalized in the W. Indies. G.C. 1848:271. R.H. 1857, p. 182.—A neat vine, growing 4–6 ft.

AAA. *Bract near the top of the sterile peduncle, entire.*

involucràta, E. Meyer. Much like *M. Balsamina*, but teeth of lvs. blunt, with a short mucro, fls. larger, bract much larger: fls. white or cream-white, often dotted with black: fr. sulfur-yellow, changing to scarlet, bursting, 2 in. long. S. Afr. R.H. 1865:350 (as *M. Balsamina*, var. *leucantha*). B.M. 6932.—A very slender and graceful climber, with the peduncle bract against the calyx, like an involucre. Int. to Amer. trade about 1890.

M. Cochinchinénsis, Spreng. (M. mixta, Roxbg.), is a large species with 3-lobed lvs., pale yellow, purple-eyed fls., 4 in. across, and an oblong, bright red fr. 4–7 in. long. Farther India. B.M. 5145. F.S. 14:1478. G.C. III. 16:531. G.M. 37:777.

L. H. B.

MONÁRDA (after Nicolas Monardes, a Spaniard, who published in 1571 a book containing the earliest picture of an American plant. See Fig. 1077). *Labiàtæ.* HORSE-MINT. This includes the Oswego Tea (*M. didyma*), one of the most brilliant of our native wild flowers, being surpassed in the intensity of its red only by the cardinal flower. It is a rather coarse herb, with large heads of gaping, wide-mouthed fls., which have none of the refinement of our cardinal flower. For mass effects, however, these plants are very striking. They grow wild along the banks of streams, lighting up the dark corners of the woods. This suggests their proper place in landscape gardening. They should be grown in masses, in wild spots against a dark background. However, they can, if desired, be grown in an ordinary sunny border without more moisture than usual. As a bedding plant they would be inferior to *Salvia coccinea*, the flowers being shorter-lived. The white- and rose-colored varieties are less desirable. *M. fistulosa* is the same type of plant, and is procurable in colors ranging from white, flesh color and lilac, through rose and crimson to deep purple, but not scarlet. This species is very variable in height. The lighter colored varieties are usually less robust.

1415. Monarda didyma (×⅓).

Monardas are easy of culture, thriving in any good soil. They spread quickly, and therefore need frequent separation, which operation is best done in the spring, as plants disturbed in the fall will often winter-kill.

Monarda is a genus of 9 species of aromatic American herbs: lvs. usually dentate: fls. often borne in dense heads, surrounded by an involucre of colored bracts; calyx tubular, 15-nerved, with 5 nearly equal teeth; corolla narrow or dilated at the throat, 2-lipped, middle lobe of the lower lip larger than the lateral; perfect stamens 2. There are 2 sections of the genus, the species here described belonging to Eumonarda, in which the heads are generally solitary and terminal, the stamens and style conspicuously thrust out, and the root perennial. The following grow 1½-2½ ft. high. One of the common Horse-Mints is *M. punctata* (A.G. 14:15), but it is not in the trade.

A. *Calyx slightly hairy at the throat.*

dídyma, Linn. (*M. Kalmiàna*, Pursh). OSWEGO TEA. BEE-BALM. FRAGRANT BALM. Fig. 1415. Stem acutely 4-angled: lvs. thin, ovate-lanceolate, acuminate. B.M. 145 (erroneously as *M. fistulosa*, var.), and 546. Vars. **álba** and **ròsea**, Hort., are offered, but the latter should be compared with the next species. In 1893 John Saul advertised *M. Kalmiana* as if horticulturally distinct, calling it the finest of Monardas.—Suited to moister positions than the others.

AA. *Calyx densely bearded at the throat.*

B. *Lvs. petioled.*

fistulòsa, Linn. WILD BERGAMOT. Sometimes called Bergamot in nursery catalogues, but the Bergamot of the Old World is *Mentha odorata*. Stem mostly obtusely angled: lvs. firmer: fls. purple. July, later than *M. didyma*. Var. **rùbra**, Gray. Fls. crimson or rosy red. Var. **mèdia**, Gray (var. *purpùrea*, Hort.). Fls. deep purple. S.B.F.G. 98. L.B.C. 14:1396 (as *M. purpurea*). Var. **móllis**, Benth. (*M. móllis*, Linn.). Fls. flesh-color to lilac. B.M. 2958 (as *M. menthæfolia*).—Will grow in dry positions.

BB. *Lvs. nearly sessile, at least below.*

Bradburiàna, Beck. Fls. light purple, spotted darker on the middle lobe of the lower lip, which is much larger than the lateral ones. June. Ill. to Tenn. and Kans. B.M. 3310 (erroneously as *M. fistulosa*).—A dryish position suits it best.

F. W. BARCLAY and W. M.

MONARDÉLLA (diminutive of Monarda, having its aspect, inflorescence and calyx). *Labiàtæ*. Annual or perennial sweet-smelling herbs, natives of California. Lvs. entire or obscurely toothed: fls. white, rose-color or purple, compacted in terminal heads with an involucre: calyx tubular, narrow or long, 10-13-nerved, 5-toothed; the teeth short, straight and nearly equal; the throat naked within; stamens 4, exserted. The following have been advertised, and can be secured through western collectors.

A. *Fls. large, comparatively few, loosely glomerate.*

macrántha, Gray. Perennial, tufted, about 9 in. high: bracts of the 10-20-fld. head sometimes whitish or purplish tinged: corolla about 1½ in. long, glabrous, orange-red, its tube fully twice the length of the calyx; the lobes lanceolate.

Var. **nàna**, Gray (*M. nàna*, Gray). Pubescent: bracts whitish or rose-color: fls. smaller; corolla not twice the length of calyx, white or tinged with rose-color, the slender tube pubescent.

AA. *Fls. smaller, more numerous, densely capitate.*

B. *Plants perennial.*

C. *Veins of lvs. numerous and prominent.*

villòsa, Benth. Bracts ovate, leafy, pinnately veined.

CC. *Veins of lvs. not prominent.*

odoratíssima, Benth. Bracts thin, membranous, whitish or pinkish, inclined to parallel venation.

BB. *Plants annual.*

lanceolàta, Gray. Lvs. lanceolate or oblong, 1-2 in. long, tapering below into slender petioles, the margins even and entire: bracts leafy, ovate or oblong, mostly acute, abundantly veined between the ribs or primary veins by cross veinlets.

M. B. COULSTON.

MONÉLLA. A section of *Cyrtanthus*.

MONÈSES (Greek, *single delight*; from the pretty solitary flower). *Ericàceæ*. ONE-FLOWERED PYROLA. A genus of one species, a low perennial herb: stem decumbent: lvs. roundish, clustered at base: fls. single, drooping, from top of slender scape 2-6 in. long, white or rose-colored, 6 lines across; petals 5, widely-spreading, orbicular; filaments awl-shaped, naked; anthers as in Pyrola, but conspicuously 2-horned. **M. grandiflòra**, S. F. Gray (*M. uniflòra*, A. Gray), grows in moist woodlands from Labrador to Alaska, in middle states and westward along the mountains. It has been offered by one dealer in native plants.

MONEYWORT, or Creeping Charlie, is *Lysimachia Nummularia*.

MONKEY FLOWER. See *Mimulus luteus*.

MONKEY PUZZLE. *Araucaria imbricata*.

MONKSHOOD. *Aconitum*.

MONOGRÁMMA (Greek, a *single line;* alluding to the elongated linear sorus). *Polypodiàceæ*. A tropical genus of several small species of grass-like ferns, rarely seen in cultivation.

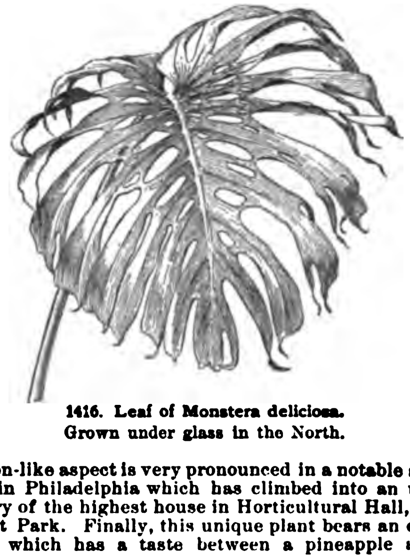
L. M. UNDERWOOD.

MONOLÈNA (Greek words referring to the single spur-like appendage on the anterior side of the anther-connective). *Melastomàceæ*. About 4 species of stemless herbs from Colombia, one of which is a small hothouse foliage plant, cult. like Bertolonia, and known to the trade as *Bertolonia primulæflora*. It has metallic green lvs. 4-6 in. long, with 3-5 parallel veins, the under surface of the lvs. a showy rosy purple. All the species have a characteristic rootstock, composed of clusters of short, thick rhizomes, prominently scarred by the falling of the lvs., and the fls. are numerous, and resemble a primrose. They are about 1 in. across, 5-petaled, pink, and borne on fleshy scapes. See *Bertolonia*.

primulæflòra, Hook. f. (*Bertolònia primulæflòra*, Hort.). Glabrous: lvs. leathery, broadly elliptical: calyx lobes broadly ovate-rounded. B.M. 5818. F.S. 18, p. 162. G.C. 1870:309, figs. 53, 54.

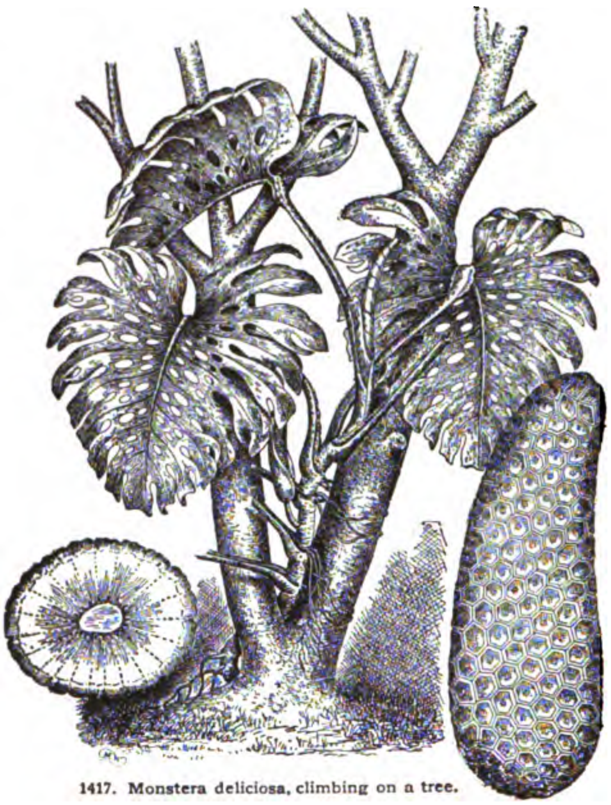
MONOPÀNAX. Referred to *Oreopanax*.

MONSTÈRA (Latin, *a monster*). *Aràceæ*. *Monstera deliciosa* is indeed a delicious monster in more senses than one. It is a favorite greenhouse climber, with huge perforated leaves, whose general appearance is sure to be remembered after the first look. (See Figs. 1416, 1417). As the plant climbs, the stems emit long, aërial roots, many of which never reach the ground, but suggest the fingers of some fabulous monster. This grotesque, dragon-like aspect is very pronounced in a notable specimen in Philadelphia which has climbed into an upper gallery of the highest house in Horticultural Hall, Fairmount Park. Finally, this unique plant bears an edible fruit, which has a taste between a pineapple and a



1416. Leaf of Monstera deliciosa.
Grown under glass in the North.

banana. The fruit grows about 6–8 in. long, and looks like a long pine cone, the rind being composed of hexagonal plates, as shown in Fig. 1417. The Monstera is a satisfactory greenhouse subject, even in a young stage, and being a great curiosity, excites much comment from visitors. It is generally kept in a hothouse, but succeeds in a coolhouse also. It is commonly allowed to grow in a spreading rather than climbing fashion; a noble specimen of this kind cultivated in Pittsburg is figured by Wm. Falconer in A.F. 7:253.


1417. Monstera deliciosa, climbing on a tree.

As a conservatory plant it does best when planted out in a bed of rich soil, where it can be kept within bounds by judicious pruning. It is not particular as to soil, as it fills the pots in which it is planted with thick, succulent roots in a very short time. It is one of the best plants for enduring the varying conditions of temperature in a dwelling house, as nothing short of a freeze seems to hurt it. Propagated by division of the stem, with part of the leaf attached while rooting.

In the American tropics *Monstera deliciosa* requires a very warm, moist climate for the production of fruit. Although it naturally grows by attaching itself to trees and creeping up, it appears to be more fruitful if compelled to grow on the ground without climbing. The fruit is green in color until it ripens, when there is just a tinge of yellow, and the outer rind comes off in bits at a touch.

Monstera acuminata is the correct name of the astonishing plant known to the trade as ***Marcgravia paradoxa***. The adult lvs. are something like those of ***M. deliciosa***, being now and then perforated, but generally pinnately cut. The young lvs. are utterly different, being much smaller, entire and heart-shaped. This is one of the most striking cases of dimorphism celebrated in horticultural annals, though that of *Ficus repens* is more familiar, and similar ones occur in Philodendron. In its young stage ***M. acuminata*** is a very handsome hothouse climber, with thick, roundish, waxy lvs., which grow in two ranks and overlap one another. When the plant was introduced by Bull, it was shown growing on a board apparently in parasitic fashion, and emitting aërial roots. It seemed most like a Marcgravia, but when it flowered and fruited the first name was found to be one of the wildest possible guesses. Marcgravia is a dicotyledon and Monstera a monocotyledon, and the two genera are as far apart as is a Camellia from a Jack-in-the-pulpit. The Monstera-like lvs. are likely to be developed when the plant reaches 15 ft. In the young stage the plant is generally allowed to clamber over a dead log or tree-fern trunk, in the manner of Philodendron, which see for culture. Monstera is a genus of 13 tropical American climbers, with lvs. more or less densely 2-ranked. Engler in DC. Mon. Phan. Vol. 2. (1879).

deliciòsa, Liebm. CERIMAN. Figs. 1416, 1417. Young lvs. 1–2 ft. long, leathery, pinnately cut, perforated. A.F. 7:253. G.M. 41:329. Gn. 21, p. 39 (poor).

acuminàta, C. Koch (*M. ténuis*, C. Koch. ***Marcgràvia paradóxa***, Bull). SHINGLE PLANT. Young lvs. a few in. long, waxy, entire. Gn. 29, p. 290 (both kinds of lvs.). G.C. II. 8:13.

WM. FAWCETT, G. W. OLIVER and W. M.

MONTANA, HORTICULTURE OF. Fig. 1418. Montana, from all standpoints, is nothing if not unique. The third largest state in the Union (Texas and California being first and second respectively), there is added to the natural capacity for great local variation found in a state covering 145,310 square miles, the additional feature of its being traversed by the main range of the Rockies. The eastern portion of the state is plains country, with a mean average altitude of 2,800 feet above sea level.

Along the southern boundary, perhaps 125 miles west of the state line, are the Wolf mountains, west of these the Rosebud and the Pryor mountains, toward the northern boundary and 175 miles west of the state line are the Little Rockies, west of these the Bear Paws, while dotted over the eastern central portion of the state are the Moccasins, the Big and Little Snowies, the Belts, the Highwoods and the Crazies. These, with the exception of the Belts, are isolated from other mountains, or detached spurs from the main range, and abound in the exceptional advantages which arise from good soil, favorable exposure and convenient means for irrigation.

About the center of the southern state line the main range of the Rockies is encountered. This range traverses the state from this point in a northwesterly direction, and after entering this range and proceeding westward one is never out of sight of mountains until reaching the western confines of the state.

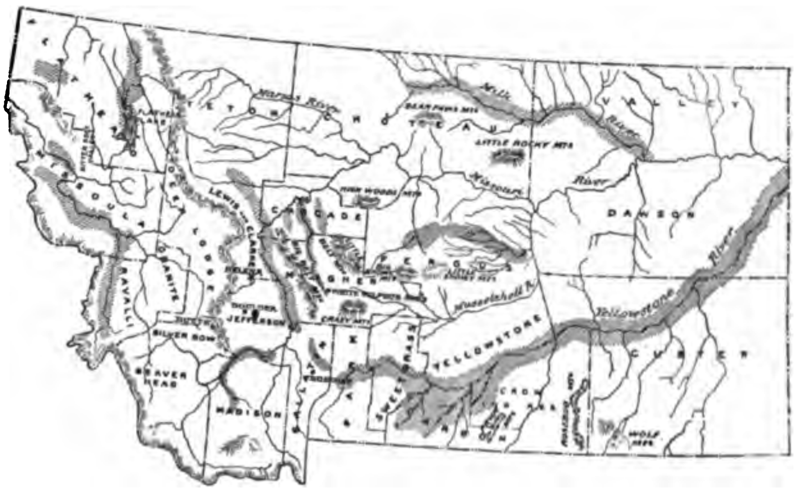
The summits of the main range vary from 7,500 to 10,000 feet above sea level, and present mighty barriers to the winter storms which sweep madly over the country to the east and south of Montana, often bringing intensely cold weather in their wake. Then, too, the climate of the state is sensibly affected by chinooks, those much misunderstood currents of warm air which rob winter of all its terrors in regions visited by them. The botanist and horticulturist have much to learn, as yet, concerning the effect of altitude upon plant growth. In a general way, it is supposed that 9,000 feet is the so-called limit of timber, though, as a matter of fact, it often happens that above this point the crowns of the mountains are composed of living rock devoid of soil and other needed adjuncts to tree growth. Illustrations of the unwillingness of plant growth to be circumscribed by altitudinal lines are found in the city of Denver, which lies 5,000 feet above sea level. There many trees have been successfully transplanted from their natural habitat at sea level along the shores of Puget Sound to a point nearly a mile aloft, and into a climate as naturally dissimilar as could well be found. In Cheyenne, Wyo., there is a luxuriant development of the black locust at an elevation of 6,100 feet. This is a tree that needs to be most carefully handled to avoid winter-killing in Minnesota, 5,500 feet nearer to sea level. Another point in instance is found in the sugar beet chart of the Department of Agriculture. This is designed to show the belt of country in the United States best adapted to beet-culture. This starts on the Atlantic in the latitude of New York city, extends nearly due westward to the western line of Wisconsin, and no drunkard ever pursued a more erratic course than it in making its way from the Great Lakes to the Pacific at the head of the Gulf of California.

Horticulturally speaking, Montana covers the entire scale of the limits of fruit production in the United States, except the citrous and other subtropical fruits. In no other state of the Union is there more need of the scientific experimenter, not so much to determine the species adapted to Montana as to wisely select the varieties of species that will give best results. There is one safe rule to observe in western fruit-tree planting,—avoid alkali soil. After an active experience of 15 years of tree-growing in Minnesota and the Dakotas, the writer is convinced that more failures in orcharding resulted there from planting in alkali soil than from any other cause. It is easy, however, to determine such conditions; very much easier under irrigation, as the application of water brings the salts to the surface, where they are easily noted, as they rapidly crystallize when exposed to the air. Within the valleys and cañons leading out from the mountains it is rare that alkali is found on suitable orchard locations.

Montana owes much of its phenomenal success in fruit culture to natural conditions; most important of these is the abundant supply of water, easily available for irrigation. Irrigation in orcharding places the tree or plant under complete control. In the growing season, water can be supplied to supplement any existing lack of moisture, and by withholding this artificial aid in the latter part of the season, perfect ripening of the wood is accomplished and the tree placed in the best physical condition to endure sudden climatic changes. Again, it is customary to flood the orchard late in the season, after the foliage has fallen, with the result that root killing is absolutely unknown in Montana. So free is the state from disasters of this nature that budded trees are succeeding remarkably well wherever they have been set in close proximity to the mountains. Another decided advantage is in the physical formation of the state; the make-up of the mountains is not, as many suppose, a shaping up of every range and peak to a sharp rocky apex, but in all ranges there are vast expanses of open plateaus extending back onto lower outlying spurs. Heading in the mountains, usually near the summits, are deep cañons leading down and out to the open plains country at the foot of the ranges. There is a constant movement of air from the upper to the lower plateaus through these cañons occasioned by the superheating of the air of the lower levels during the middle of the day. The heat, in rising, causes a partial vacuum, and the cooler air of the upper levels flows down to occupy this. This is especially true in the earlier night hours. So common is this as to give the name "cañon breezes" to these currents, which are plainly to be felt miles away from every extensive cañon's mouth far out on the open plains. This constant current of air, passing over the surface of the earth, wards off frosts and gives fruit immunity from this great cause of loss to those growing fruit outside of mountain districts.

Early orcharding was attended with almost prohibitive conditions. In 1864, trees were set in Missouri valley by John G. Pickering, who is still living and planting. Some of the trees originally set are alive and bearing. Trees then came in by way of Utah on pack horses, and were sold for from $2.50 to $5 each. The next plantings were made near the present site of Stevensville, in the Bitter Root valley, by Bass Bros. Their apple crop for 1898 was estimated at 10,000 boxes. The Bitter Root valley is in the southwestern part of Montana, and is about 100 miles in length, with an average width of perhaps 10 miles. This valley has been the scene of the greatest activity in orcharding to date. It has an altitude of about 3,200 feet, and as it lies to the westward of the main range of the Rockies, it possesses marked advantages over the country to the eastward. It also has a soil exactly adapted to apples, pears, cherries, plums, grapes and small fruits. The soil is of decomposed granite, with an almost total absence of alkali. To the casual observer it appears to be light, stony, gravelly and comparatively worthless, but quite the reverse is the case. The main difficulty is to restrain undue growth of tree and superabundant fruitage. It is a soil that does not bake after irrigation, hence water can be freely used, and in a way stored, as evaporation does not occur from capillary attraction, as is always the case when there is too great a preponderance of clay in the texture of the soil. It is within bounds to state that upon soils carrying a heavy percentage of clay, fully one-half of the benefits arising from irrigation are lost from the inability of the farmer to cultivate immediately after irrigation. Bitter Root orchards range from 100 trees set for home use to 500-acre blocks for commercial purposes. The main difficulty there experienced is in the selection of the best varieties for general planting.

The pomologist can find in this one valley every variety of apple that is now growing in the combined nurseries of New York state. The only bars there found to the successful cultivation of all standard and small fruits is the brevity of the growing season and the coolness of summer nights; owing to altitude the air is rare and does not retain heat after sundown, as is the case in the lower-lying and more humid sections of the United States. The clearness of the atmosphere and attendant brilliancy of the sun gives to fruit such coloring as is never noted, except in similar altitudes; and while extended experiments have not been conducted along these lines, it is believed that the proper use of water in irrigation does not necessarily imply that the fruit thus grown carries an undue percentage of moisture when compared with fruits grown without irrigation.



1418. Montana.
The shaded parts show horticultural areas.

In the phenomenally dry season of 1894, Early Rose potatoes grown in Wisconsin were analyzed, as also were Montana Early Rose grown under irrigation, and the moisture content of the Wisconsin potatoes was considerably higher than that of the Montana potatoes.

What has been done in the valley of the Bitter Root is being attempted in Flathead valley, a large northwestern valley, with the best results. The range of varieties is fully as wide as that of the Bitter Root, and as the altitude is about 400 feet less it is to be expected that fully as good results will eventually be attained.

Some difficulty is experienced from frosts in the Flathead country, but as the heavy growth of deciduous and conifer timber, which covers the majority of the bench lands in this region, is cut off, no doubt the increased circulation of air will prevent serious loss to fruit from frost. Among other valleys achieving marked success in fruit and vegetable culture, are those of the Gallatin, Yellowstone, Upper and Lower Missouri, Clark's Fork of the Yellowstone, the Judith, Milk, Marias, Teton, Madison and Jefferson. In these valleys the better apples, cherries and plums are readily grown, and it is safe to say there are not 160 acres of farm lands in the state where, if the planter will avoid alkali soil and set trees with reference to the possibility of irrigating them, the Transcendant and Hyslop crabs, and the hardier of the standard apples, together with the small fruits, cannot be successfully grown. S. M. Emery.

MONTBRÈTIA. See *Tritonia*.

MONTEREY CYPRESS. *Cupressus macrocarpa*.

MÓNTIA (Guiseppe Monti, professor of botany at Cologne in the first half of the eighteenth century). *Portulacàceæ*. About 18 species of American herbs, including the Winter Purslane, a salad or pot-herb known to the European trade as *Claytonia perfoliata*. This odd plant is perhaps cult. in America by a few fanciers of rarer kinds of vegetables. In hot countries it may be more desirable. It is an annual plant forming a compact tuft about 9–12 in. high. The lvs. are all from the root, tender, thick, fleshy, with a slender petiole about 2 in. long, and a blade about ½ in. long, which varies from lanceolate to rotund. The most remarkable feature is a sort of cup an inch or more in diameter, from which arise the racemes of small white fls. One of these cups crowns each of the stems, which are numerous, slender, leafless, and about twice as long as the lvs. The name "perfoliata" is suggested by the resemblance of the cup to a perfoliate leaf. In *M. perfoliata* the cup is usually 2-lobed, and the species runs into *M. parviflora*, which rarely has the cup transformed into two almost disjoined lvs. The Winter Purslane is now a weed in many parts of the world. The seed may be sown all through spring and summer where the plants are to stand.

Montia cannot be distinguished from Claytonia by any one character, but the cultivated plants of both genera have been sufficiently discriminated here and under Claytonia. The latest monograph is by B. L. Robinson in Syn. Flo. N. Amer., Vol. I, part I, fasc. II (1897).

A. *Stems without true lvs.*

B. *Pedicels short, seldom exceeding the fruiting calyx.*

perfoliàta, Howell (*Claytònia perfoliàta*, Don). Winter Purslane. Rather coarse, green, often reddening with age. Banks of streams, Calif. to Ariz. and Mex., north to Brit. Col.; common near Pacific coast. It grows wild in Cuba but is not native there, as often stated. B.M. 1336. R.H. 1897, p. 159.

BB. *Pedicels in fruit 2–6 lines long, much longer than the calyx.*

parviflòra, Howell (*Claytònia parviflòra*, Dougl.). More slender, green or slightly glaucous. Calif. to Brit. Col., east to Idaho and Utah.

AA. *Stems with numerous small alternate lvs.*

parvifòlia, Greene (*Claytònia parvifòlia*, Moc.). Fls. rose-color to white. Plant has bulblet-like offsets. Moist rocks, Brit. Col. to Rockies in Mont. and Alaska. This and the preceding one have been advertised, but have little if any ornamental value. W. M.

MOON DAISY. Name used in England for *Chrysanthemum Leucanthemum*.

MOONFLOWER in America always means *Ipomœa Bona-Nox* and related species; in England it rarely, if ever, means this, but *Chrysanthemum Leucanthemum* our common white weed or ox-eye daisy. Moonflower in England also means occasionally ***Anemone nemorosa*** and *Stellaria Holostea*.

MOONSEED. *Menispermum Canadense*.

MOONWORT. *Botrychium;* also *Lunaria*.

MOOSEWOOD. *Dirca palustris* and *Acer Pennsylvanicum*.

MORÆA (probably named after Robert More, botanist, Shrewsbury, Eng.). Moræas are charming bulbous plants much like Irises, but unfortunately they are not so hardy as the common Irises and the individual fls. last only a day or so. Moræa is a genus of about 60 species, 45 of which are S. African, while the rest are chiefly from tropical Africa. Moræa is the African representative of Iris. No one character will separate the two genera. Moræas have no perianth tube, while Irises usually have one. The filaments are usually monadelphous in Moræa and free in Iris. Irises grow either from rhizomes or bulbs, while Moræas mostly grow from corms, except the subgenus Dietes, which grows from a rhizome. Most of the showiest Moræas belong to the subgenus known as Moræa proper. Species 7–13, described below, belong to this group. There is another subgenus which differs from it in having the ovary extended into a long beak which looks like a perianth tube, but none of this group is cult. The Moræas proper are about as tender as other Cape bulbs. The amateur may find some suggestions as to their culture under ***Bulbs***, *Iris* and *Ixia*.

By far the largest and most remarkable plant of the genus is *Moræa Robinsoniana*. This grows 6–8 ft. high and has the habit of the New Zealand flax, ***Phormium** tenax*. A splendid specimen mentioned in B.M. 7212 bore 457 flowers between June 20 and Oct. 1. The individual fls. are 4 in. across, fragrant and last only a day. At Kew this noble plant has been successfully grown in the south end of a house. The stately plant pictured in G.F. 10:255 grew in a Californian garden and was said to be 16 years old from seed. The finest picture, however, is that in G.F. 4:355.

INDEX.

bicolor, 3.
Dietes, 10.
edulis, 9.
fimbriata, 8.
glaucopis, 5.
iridioides, 2.
juncea, 11.
longifolia, 9.
lutea, 4.
papilionacea, 7.
Pavonia, 4.
polyanthos, 13.
Robinsoniana, 1.
spathacea, 10.
tricuspis, 4, 6.
tristis, 12.
villosa, 4.

A. *Rootstock a short creeping rhizome. (Subgenus Dietes).*
  B. *Color of fls. chiefly white.*
    C. *Height of plants 6–8 ft.* .... 1. **Robinsoniana**
    CC. *Height of plants 1–2 ft.* .... 2. **iridioides**
  BB. *Color of fls. chiefly yellow* ..... 3. **bicolor**
AA. *Rootstock a tunicated corm.*
  B. *Inner segments inconspicuous. (Subgenus Vieusseuxia).*
    C. *Color of fls. chiefly orange-red* .... 4. **Pavonia**
    CC. *Color of fls. chiefly white.*
      D. *Spots blue* .... 5. **glaucopis**
      DD. *Spots brown* .... 6. **tricuspis**
  BB. *Inner segments conspicuous.*
    C. *Height of stems 1–3 in.*
      D. *Lvs. hairy all over* .... 7. **papilionacea**
      DD. *Lvs. hairy only at the edges.* 8. **fimbriata**
    CC. *Height of stems more than 3 in.*
      D. *Stems provided with 1 long wiry leaf, just below the inflorescence* .... 9. **edulis**
      DD. *Stems not so provided.*
        E. *Fls. usually 1 or 2 on a stem* ....10. **spathacea**
        EE. *Fls. loosely corymbose. fls. small.*
          F. *Spathes ½–¾ in. long* ....11. **juncea**
          FF. *Spathes 1½ in. long* ....12. **tristis**
13. **polyanthos**

1. **Robinsoniàna,** Hook. (*Ìris Robinsoniàna*, F. Muell.). WEDDING IRIS. Outer segments spotted red and yellow near base. B.M. 7212. G.F. 4:355; 10:255. J.H. III. 32:569. G.M. 34:569. G.C. 1872:393; III 9:457.

2. **iridioides,** Linn. Stem 1–2 ft. long, with many short, sheathing, lanceolate bracts: lvs. in fan-shaped basal rosettes: fls. over 3 in. across, white, marked yellow on claws of outer segments; style crests marked with blue. B.M. 693. L.B.C. 19:1861 (*Iris crassifolia*).

3. **bicolor,** Steud. Habit of *M. iridioides:* fls. 2 in. across, yellow, with beautiful brown spots on the outer segments; style crests yellow. B.R. 17:1404. L.B.C. 19:1886. P.M. 9:29 (all as *Iris bicolor*).

4. **Pavònia,** Ker. (*Ìris Pavònia*, Linn. f.). Outer segments without a distinct claw, orange-red, with a blue-black or greenish black spot at the glabrous base. B.M. 1247.—Var. **villòsa,** Baker. Lvs. pilose: outer segments bright purple, with a blue-black spot on the hairy claw. B.M. 571 (*Ìris villosa*). Var. **lùtea,** Baker. Lvs. glabrous: fls. yellow, unspotted. B.M. 772 (*Moræa tricuspis*, var. *lutea*). In *M. Pavonia* and *glaucopis* the inner segments have a large central cusp and 2 lateral lobes, while in *M. tricuspis* the inner segments have 3 large cusps.

5. **glaucòpis,** Drap. Outer segments white, with a blue spot. B.M. 168 (erroneously as *Iris Pavonia*).—In this species the outer segments have a short, distinct claw, while *M. Pavonia* has none.

6. **tricúspis,** Ker. Outer segments whitish or lilac, with a purplish spot. B.M. 696.

7. **papilionàcea,** Ker. Fls. red or lilac, yellow on the claw; style crests erect. B.M. 750.

8. **fimbriàta,** Klatt. Fls. lilac. R.H. 1867:271.

9. **édulis,** Ker. Fls. lilac, spotted yellow. B.M. 613.—Var. **odòra** has white fls. Var. **longifòlia** has yellow fls. B.M. 1238.

10. **spathàcea,** Ker. Fls. yellow. B.M. 6174 (*Dietes Huttoni*).

11. **júncea,** Linn. Fls. lilac, in 2–3 clusters.

12. **tristis,** Ker. Lvs. 2–3, produced near the base, 1–2 ft. long: clusters of fls. 4–6: fls. dull lilac, ochre or salmon-colored, with a yellow spot. B.M. 577 (*Iris tristis*).

13. **polyánthos,** Thunb. Lvs. about 3, one from near the base of the stem, the others from the lower forks, ½–1 ft. long: clusters of fls. 5–20: fls. lilac.

M. Macleaii, advertised 1800 by Van Tubergen, is said to belong to the subgenus Dietes.—*M. Sisyrinchium* = Iris Sisyrinchium.

W. M.

MOREL. See *Mushroom*.

MORÌNA (Louis Morin, a French botanist, 1636–1715). *Dipsàceæ.* Seven or 8 species of perennial herbs in western and central Asia, from 3 in. to 4 ft. high. Lvs. opposite or whorled, narrowly oblong or linear, spinous-toothed: fls. whorled; whorls in spikes, surrounded by wide-based floral lvs.; bracteoles among the fls. few, spiny.

longifòlia, Wallich. A handsome plant 2 ft. high, with thistle-like foliage: lvs. 6 in. long, 1 in. across: fls. showy, deepening from white in the bud to pink and finally crimson, crowded in dense whorls near the top of stem. Hardy. Cult. in light, sandy soil, with partial shade. Prop. by seed and by division in early autumn. Useful in the rockery and border, and with other foliage plants. June–Aug. Himalayas. B.M. 4092. B.R. 26:36. R.H. 1857:514.—Whorl-flower is a catalogue name.

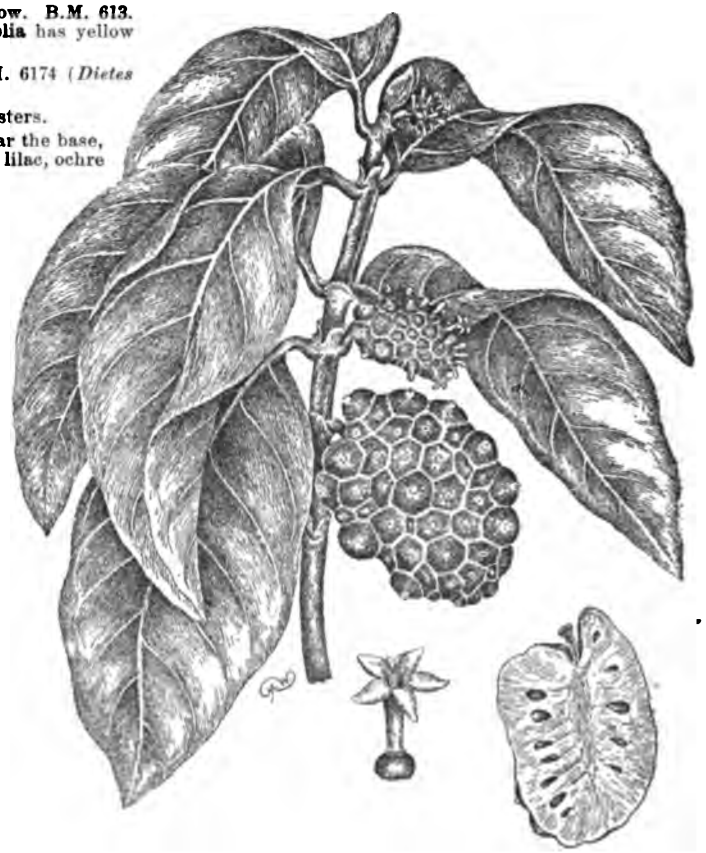
MORÌNDA (Latin, *morus*, mulberry, and *Indica*, Indian). *Rubiàceæ.* This includes the Indian Mulberry, *M. citrifolia*, a tropical fruit tree cult. in S. Fla. and S. Calif. (see Fig. 1419). It has heads of small white fls., followed by globose or ovoid, berry-like fruits about 1 in. long. The genus contains about 40 species of shrubs, trees and climbers in tropical Asia, Australia and the Pacific islands, and 3 or 4 tropical American species. Lvs. opposite, rarely in 3's: fls. white, in axillary or terminal, simple, panicled or umbellate heads; corolla tube short or long; lobes 4–7, coriaceous, valvate in the bud.

citrifòlia, Linn. INDIAN MULBERRY. Fig. 1419. A small tree, with shining, broad or narrow, oval lvs. on very short petioles: stipules large, broadly oblong or semi-lunar; fl.-head on solitary peduncles 1 in. long usually in the axil of every other pair of lvs.: calyx limb truncate: corolla 5–7 lobed, tube about ⅛ in. long: fruits yellowish, fleshy, in a globose or ovoid head about 1 in. in diam. G.C. II. 11:333.

Var. **bracteàta,** Hook. Stipules more acute: calyx limb often with a lance- or trowel-shaped, white, leafy lobe, sometimes 3 in. long. Offered in S. Calif. and Fla.

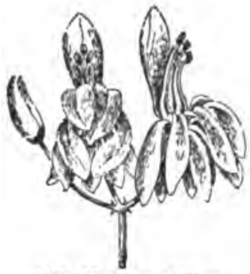
M. B. COULSTON.

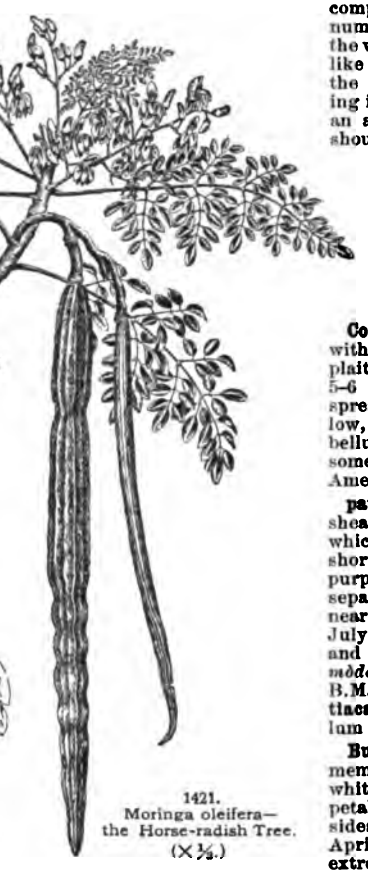
MORÍNGA (altered from the native Malabar name). *Moringàceæ.* Only three species comprise the family Moringaceæ, all members of the genus Moringa. They are small, spineless trees, with alternate, deciduous, pinnate lvs., axillary panicles of rather large, white or red fls., and long, pod-like fruits. They are native of N. Africa and the tropical parts of Asia. The position of the family Moringaceæ is difficult to determine. Bentham & Hooker ally it with Anacardiaceæ. Engler and Prantl place it between Resedaceæ and Sarraceniaceæ. Grisebach joins it to the Capparidaceæ. Others ally it



1419. Morinda citrifolia branch with leaves, flowers and fruit (× ⅔). Also vertical section of fruit (fruit sometimes larger) and enlarged flower below.

with the Leguminosæ, which it resembles in external appearance. Fls. perfect, 5-merous; calyx cup-shaped, 5-cleft, the lobes reflexing; petals 5, one of them erect and larger; fertile stamens 5, alternating with 5 or 7 staminodia, the anthers attached on the back, and 1-loculed: fr. a long, 4-9-angled, 1-loculed pod with 3 valves, the seeds immersed in the spongy contents of the valves.


1420. Moringa oleifera About natural size.


1421. Moringa oleifera—the Horse-radish Tree. (×⅛.)

oleifera, Lam. (*M. pterygospérma*, Gærtn.). HORSE-RADISH TREE. Figs. 1420, 1421. Small tree (reaching 25 ft.), with soft wood and corky bark, the young parts pubescent: lvs. mostly 3-pinnate, 1-2 ft. long, all parts stalked: fls. whitish, stalked, fragrant, 1 in. across: pod often 1½ ft. long, 9-ribbed, bearing 3-angled, winged seeds. India, but now spontaneous in parts of the W. Indies.—The Horse-radish Tree is so named from the pungent taste of the root, which is sometimes eaten. The young fr. is also edible. The seeds (called ben-nuts) yield an oil, which is more or less used in the arts. The tree is sometimes cult. in the extreme southern U. S.

L. H. B.

MORMÒDES (Greek, *a grotesque creature*). *Orchidàceæ.* This genus is remarkable for the interesting form of its flowers, which suggested the name given to the genus by Lindley. The plants are rather large, with long, tapering pseudobulbs sheathed by the dry bases of the fallen lvs.: lvs. long, plaited, deciduous in the autumn: raceme from the base of the pseudobulbs bearing many showy fls.: sepals and petals subequal, mostly narrow; labellum firmly united with the column, with revolute margins, rarely concave, turned to one side; column without appendages, twisted in the opposite direction from the labellum. Distinguished from the closely related genus Catasetum by its perfect fls. and wingless column.

Mormodes are commonly found in poor condition among the collections, which is the result of neglect rather than difficulty of cultivation. They should be grown in small baskets suspended from the roof, in a compost of equal parts of clean chopped peat-fiber, sphagnum and sod, interspersed by nodules of charcoal, and the whole pressed in firmly around the roots. The roots like to work among the charcoal, and this also serves the purpose of dividing the compost, thereby allowing it to dry out more readily. Mormodes do not require an abundance of water at any time, and the compost should frequently be allowed to dry out during the growing season. When at rest, an occasional application will suffice to keep the soil moist and the pseudobulbs from shriveling. Rebasketing should take place at the commencement of new growth in spring. They all require warmhouse temperature; the Cattleya or Cypripedium department affords them a proper location regarding temperature and moisture.

Cult. by ROBERT M. GREY.

Colóssus, Reichb. f. Pseudobulbs 6-12 in. long, clothed with brown sheaths: lvs. elliptic-ovate, 10-15 in. long, plaited: raceme inclined, 2 ft. long, with the stalk: fls. 5-6 in. across; sepals and petals narrow-lanceolate, spreading or reflexed, with recurved margins, pink below, changing to yellow toward the upper portion; labellum ovate, long-acuminate, very revolute, yellow, somewhat sprinkled with pink dots. March. Cent. Amer. B.M. 5840.—A plant of striking appearance.

pardina, Batem. Pseudobulbs 4-7 in. high, stem-like, sheathed by the bases of the lanceolate, striate lvs., which are 4 times as long: raceme nodding, many-fld., shorter than the lvs.: fls. yellow, spotted with reddish purple, fragrant, crowded on the upper end of the stalk; sepals and petals ovate, pointed, convergent; labellum nearly like the segments but with 2 lateral acute lobes. July, Aug. Mex. B.M. 3900. F.C. 3:113.—A curious and rather rare plant. Var. **unicolor**, Hooker (*Marmòdes citrina*, Hort.). Fls. of one color, all yellow. B.M. 3879. I.H. 1:25. G.C. III. 14:181. Var. **aurantiaca**, Rolfe. Sepals and petals golden yellow; labellum yellow. I.H. 39:144.

Buccinàtor, Lindl. Plants 1-2 ft. high: lvs. lanceolate, membranous, striate: fls. pale green, with an ivory-white lip; sepals linear-oblong, the lateral ones reflexed: petals erect; labellum subrotund-cuneate, with the sides rolled back, giving it the appearance of a trumpet. April. Mex. B.M. 4455 (*M. lentiginosa*).—This plant is extremely variable in color, ranging from nearly white to chocolate-brown, the various forms being either spotted or plain. Its forms have been described under at least 7 distinct specific names.

luxàta, Lindl. Pseudobulbs 4-6 in. long: sheathing lvs. 1-2 ft. long, narrow-lanceolate, plaited: raceme much shorter: fls. 2 in. in diam., rather fleshy and globular, lemon-yellow, with a dark brown streak down the labellum; sepals ovate-lanceolate; petals oblong, concave; labellum hemispherical, concave, obsoletely 3-lobed. July. Mex. B. R. 29:33. R.H. 1889:132.—Very fragrant. The fls. are remarkably distorted. Var. **ebúrnea**, Hort. Fls. creamy white. This is a very effective plant, superior to the type. G.C. II. 18:145. I.H. 34:35.

HEINRICH HASSELBRING.

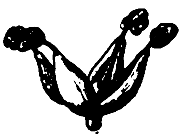
1422. Staminate catkin of Russian Mulberry. Natural size.

1423. Pistillate catkin of Russian Mulberry. Natural size.

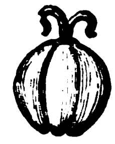
MORNING-GLORY. *Ipomœa purpurea.*

MORRÈNIA (Professor Charles Morren, Belgian botanist). *Asclepiadàceæ.* One or two pubescent twining shrubs of S. Amer., allied to Cynanchum, but differing in its convex 2-lobed stigma (flat or concave in

Cynanchum) and the tubular corona, which is longer than the pistils, villose on the inside, and conniving over the pistils. The lvs. are opposite and hastate. **M. odoràta,** Lindl., is offered by Franceschi, S. Calif. It has white fragrant fls. in dense cymes in the axils. Described by Lindley as long ago as 1838, but appears never to have been brought into cultivation. Franceschi says it is "a noble vine; foliage very distinct." Argentine and Paraguay.



1424.
Staminate flower of
Russian Mulberry.
Enlarged.



1425.
Pistillate flower of
Russian Mulberry.
Enlarged.

MÒRUS (the ancient Latin name). *Urticàceæ* or *Moràceæ*. MULBERRY. About 100 species of Mulberry have been described, but the latest monographer (Bureau, DC. Prodr. 17:237 [1873]) reduces them to 5. Some of the names are now referred to other genera. Many of the names represent cultural forms of *M. alba*. Mulberries are grown as food for silkworms and for the edible fruits. The silkworm Mulberry of history is *M. alba*, and the fruit-bearing Mulberry of history is *M. nigra*. Yet, strangely enough, the leading fruit-bearing varieties of North America are derived from *M. alba* (see Bailey, Bull. 41, Cornell Exp. Sta., and "Evolution of Our Native Fruits"). The native *M. rubra* has also given varieties which are grown for their fruits. The silkworm Mulberry of the Chinese is *M. multicaulis*, by some considered to be a form of *M. alba*. This was introduced into North America early in the century, and for a time there was the wildest speculation in the selling and planting of the Mulberry tree, and in the rearing of silkworms. These efforts have now largely passed away in North America. *M. multicaulis* gave rise to one variety which was prized for its fruits, the Downing. This variety is now little known, but the name has been popularly but erroneously transferred to a good variety of *M. alba* (the New American).

The Mulberries are trees of the temperate regions of the Old and New World. The genus Morus usually has monœcious flowers, both sexes being in small hanging axillary catkins, the males soon falling (Figs. 1422–23). The calyx is 4-parted: stamens 4, the filaments partially inclosed in the calyx-lobes (Fig. 1424). In the pistillate flower there is one ovary with 2 stigmas, and the 4 calyx-lobes are adherent to the ovary (Fig. 1425). The pistillate flowers become fleshy and cohere into a long multiple fruit which suggests a blackberry in external appearance (Fig. 1426).

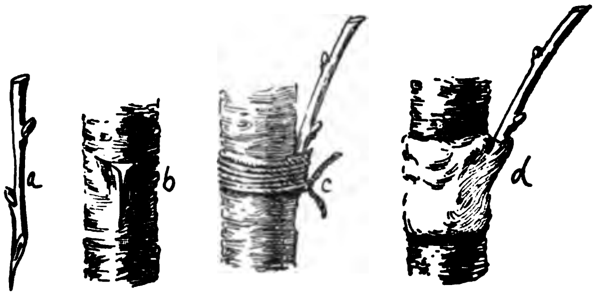
1426. Fruit of Morus alba. Natural size.

In North America the Mulberry is known chiefly as a fruit-bearing tree, although it is never planted extensively and the fruit is scarcely known in the market. Two or three trees about the home grounds are sufficient to supply a family. The fruits are sweet and soft. To many people they are too sweet. Because of their sweetness they are of little value for culinary uses. They usually drop when ripe. They are harvested by being shaken on sheets or straw. Birds are exceedingly fond of them. In the East and North, varieties of *M. alba* are chiefly grown, as the New American (Downing of most present nurseries), Thorburn and Trowbridge. On the Pacific coast and in some parts of the South, varieties of *M. nigra* are grown, particularly the Black Persian. In parts of the South forms of the native *M. rubra* are grown, as Hicks and Stubbs. These are popular for planting in hog pastures, as the animals like the fruits. The Mulberry thrives in any garden soil. It does well even on thin gravels and rocky slopes. For fruit-bearing purposes, trees may be planted from 20 to 40 feet apart.

The Russian Mulberries are offshoots of *M. alba*. Their particular merits are great hardiness to withstand cold, drought and neglect. They are useful for low wind-breaks and also for sheared hedges. They have become popular on the plains. They are readily propagated by seeds, and the resulting plants are variable. Now and then a large-fruited form appears and it may be named and propagated, but for the most part the Russian Mulberry has little merit for its fruits unless one desires to feed the birds.

Varieties of Mulberries are now mostly worked on seedlings of the Russian. One of the most successful grafts is S. D. Willard's method, shown in Fig. 1427. The grafting is performed in spring when the bark will slip, using cions which have been kept perfectly dormant or on ice. *a* is the cion, the lower part being cut thin so that it will enter readily between the bark and wood of the stock. *b* is the stock, with an incision made through the bark essentially as for shield-budding. *c* shows the graft bound with raffia. *d* shows the completed operation, the work being covered with grafting wax. *Morus multicaulis* grows from cuttings in the South. These cuttings, with the buds removed to prevent sprouting, are often grafted before they are planted with a long cion of the desired variety (see Fig. 941). The cutting acts as a nurse, and the cion takes root of itself if set deep enough.

There are many Mulberries with ornamental forms. Of these, the most popular in America at present is Teas' Weeping, a chance seedling of the Russian Mulberry tribe. When grafted several feet high on straight Russian stock, it makes one of the best of small weeping lawn trees (Fig. 1428). It originated on the grounds of John C. Teas, Carthage, Mo., about 1883. Various cut-leaved forms, mostly of *M. alba*, are seen in fine collections, of which the form known as *M. nervosa* (Fig. 1429) is one of the best. The foliage of Mulberries is interesting because so variable. Even on the same tree there may be leaves of several forms, while different trees of the same species may show strong individual traits. The most striking variations are in the lobing of the leaves.



1427. A method of grafting the Mulberry.
a, the cion; *b*, matrix to receive cion; *c*, the graft tied; *d*, the graft waxed.

A. *Lvs. mostly bright and glabrous above, and usually glossy.*

B. *Style very short or practically none.*

àlba, Linn. WHITE MULBERRY. Figs. 1430, 1432 B. Lvs. light green, rather small, smooth or very nearly so above and often shining, the veins prominent beneath and whitish, variously lobed or divided, the basal lobes unequal, the teeth large and for the most part rounded or nearly obtuse, the branches gray or grayish yellow: fr. variable, usually narrow, 1–2 in. long, white or violet, very sweet. China.—*Morus alba* has been cultivated from the earliest times, chiefly for feeding the silk worm. It is a frequent tree along roadsides and in the old yards in the eastern states, where the trunk sometimes attains a diameter of two feet. This half-wild form usually has rather small rounded shining leaves with very large rounded teeth, and bears little whitish or violet fruits, which are very sweet. Sometimes the fruits are an inch long, but they are oftener only half that length, and one sometimes finds trees on which the fruits are barely a quarter of an inch in length. Now and then a tree bears fruit nearly or quite black. Birds, poultry and hogs are fond of these Mulberries. The trees are usually very thick-topped and bushy growers, but occasionally one is seen which, when young, has branches as straight and trim as a Northern Spy apple. These half-wild trees are seedlings, and this accounts for their variability.

1428. Teas' Weeping Mulberry.

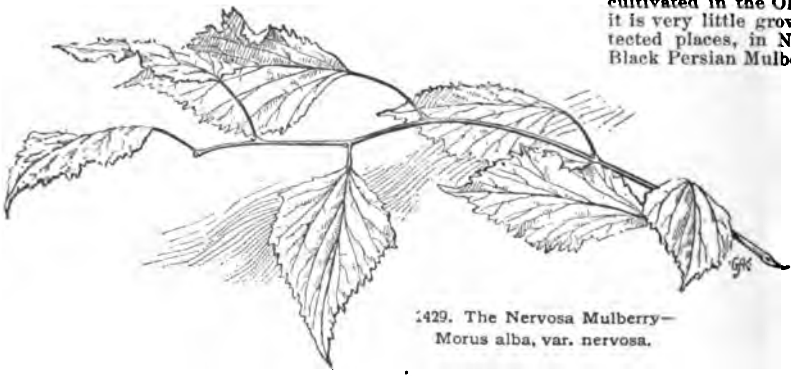
Var. **Tatárica,** Loudon (*M. Tatárica*, Linn.). RUSSIAN MULBERRY. Figs. 1422-25, 1431. A hardy type of *Morus alba* which was introduced into our western states during 1875-77 by the Russian Mennonites. It differs little from the type of *Morus alba* in botanical characters. As commonly seen, it is a low-growing very bushy-topped, small tree with small and much-lobed lvs. The fruit is usually very small and insipid, and varies from creamy white to violet, deep red and almost black.

Var. **nervòsa,** Hort. Fig. 1429. Lvs. contracted and jagged, and very strongly marked with many white veins. It bears fruit a half-inch long. Among the horticultural curiosities this tree should find a place, although it is not grown by our nurserymen. Its ornamental value is considerable, especially when striking effects are desired. Rare in America. A large specimen stands in the grounds of the Department of Agriculture at Washington. The history of the Nervosa Mulberry is obscure. Delile described it in a French periodical as long ago as 1826, and it is described in monographic works. It is of horticultural origin.

The following names, which one may find in horticultural literature, are referable to *M. alba: cedròna* (?), *colombássa, Constantinopolitàna, globòsa, intermèdia, Itálica, laciniàta* (of some), *lùcida, membranàcea, macrophýlla, Morétti, Romàna, ròsea, urticæfòlia.*

BB. *Style evident or even prominent.*

Japónica, Audib. (*M. álba*, var. *stylòsa*, Bureau). Lvs. usually large, dull, rather thin, long-pointed, the rounded teeth very large and deep, or the margin even almost jagged, the leaves upon the young growth usually deeply lobed. China, Korea, Japan.—This species has been introduced lately. It is tender in the North when young. The fruit is described as short-oblong and red.

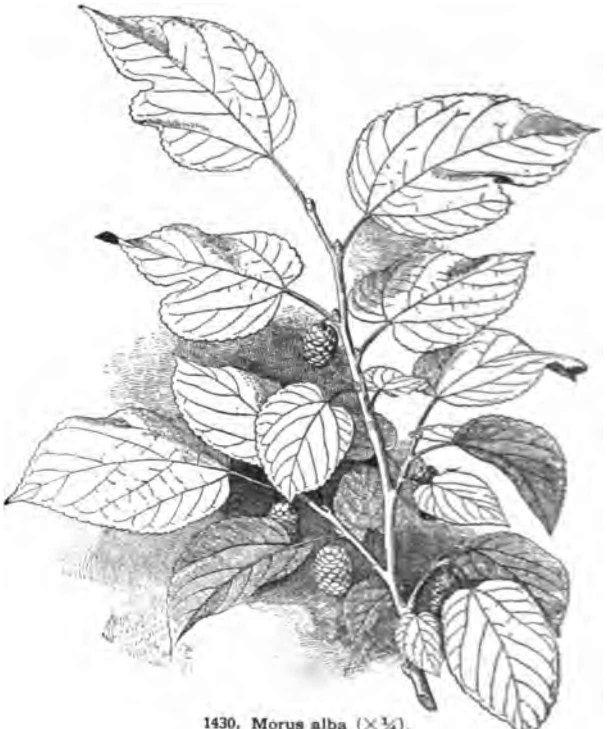


1429. The Nervosa Mulberry—Morus alba, var. nervosa.

AA. *Lvs. dull green, mostly rough or pubescent.*

B. *Full-grown lvs. more than 4 in. long.*

multicaùlis, Perr. (*M. dlba*, var. *multicaùlis*, Loudon. *M. alba*, var. *latifòlia*, Bureau. *M. Sinénsis*, Hort. *M. latifòlia*, Poir., which Bureau refers here, is probably *M. Indica*, Linn.). Fig. 1432 A. A strong-growing small tree or giant shrub, with dull, roughish and very large, long-pointed lvs., which are seldom or never prominently lobed, and which are often convex above, bearing black, sweet fr.; style evident. China, where it is the chief silkworm Mulberry.—Once much grown in this country, but not now well known, particularly not in the North.



1430. Morus alba (×¼).

nigra, Linn. BLACK MULBERRY. Lvs. dark, dull green, rather large, tapering into a prominent point, commonly very rough above, usually not lobed, the base equal or very nearly so on both sides, the teeth rather small and close, the branches brown: fr. large, comparatively thick and fleshy, mostly dark-colored. The black Mulberry is a native of Asia, probably of Persia and adjacent regions.—This is the species which is cultivated in the Old World for its fruit. In America it is very little grown. It is not hardy, except in protected places, in New England and New York. The Black Persian Mulberry of the South and of California is probably of this species.

rùbra, Linn. NATIVE RED MULBERRY. Fig. 1433. Lvs. usually large, very various, those on the young shoots deeply lobed with very oblique and rounded sinsues, in the base of which there are no teeth, the upper surface rough and the lower one soft or variously pubescent, the teeth medium or comparatively small and either rounded or bluntish: fr. deep red, or when fully ripe almost black, variable in size, often very good, nearly always having an agreeable slight acidity. Mass. to Fla., Kans. and Tex., mostly in rich soils and bottom lands. S.S. 7:320.—This native Mulberry has been tried for the feeding of silkworms, but with indifferent success. At least three of the named fruit-bearing Mulberries belong to it, and a yellow-leaved Mulberry, which is somewhat grown for ornament, also appears to be of this species. The curious lobing of the lvs. on the young growth is shown in the upper spray of Fig. 1433. The nearest approach to this lobing is in the Japanese (*Morus Japonica*), and this affords another of those interesting parallelisms which exist between the Japanese and eastern American floras. The red Mulberry is the largest tree of the genus. In the South it often attains a height of 70 ft. and a diam. of 3 or 4 ft. The timber is used for posts and light woodwork.

1431. Russian Mulberry—Morus alba, var. Tatarica (× ¼).

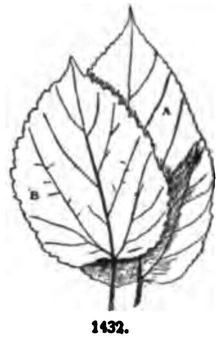
Var. **tomentòsa**, Bureau. (*M. tomentòsa*, Raf.). Lvs. very soft-pubescent and whitish beneath, often glossy but rough above. Tex.—A large-fruited form of this was introduced in 1889 by T. V. Munson as the Lampasas Mulberry.

BB. *Full-grown lvs. usually 3 in. or less long.*

celtidifòlia, HBK. (*M. Mexicàna*, Benth. *M. microphýlla*, Buckl.). Much smaller tree than *M. rubra*, rarely more than 25 ft. tall, and with smaller and smoother lvs. and smaller, sourer black fr., which ripens earlier and is not so good. Lvs. cordate-ovate, more or less lobed, mucronate-serrate, nearly smooth on both sides: fr. short-ovate or sometimes nearly globular. Tex. and Ariz. to Ecuador. S.S. 7:321.—Occasionally planted for its fruits. L. H. B.

MOSQUITO PLANT. See *Cynanchum*.

MOSS. A general name for many humble green plants of the cryptogamia (flowerless plants), mostly with distinct stems and foliage leaves. In North America there are about 1,200 species, distributed in numerous families and four orders. They have solitary, mostly stalked spore-cases or capsules arising from the apex of a leafy stem (Fig. 1434). The capsule is covered with a thin cap or calyptra (c) which is shed at maturity. The capsule opens by means of a lid or operculum (o), and the orifice is usually guarded by one or two rows of teeth or a peristome. None of the Mosses are horticultural plants, although Sphagnum Moss is much used as a packing material and for holding moisture about pots, and as a medium in which to sow delicate seeds. It is collected from bogs. Club Mosses are not true Mosses, but lycopodiums (which see). The "Moss" on fruit and other trees is mostly lichen. The Florida or Spanish Moss is a flowering plant (see *Tillandsia*). L.H.B



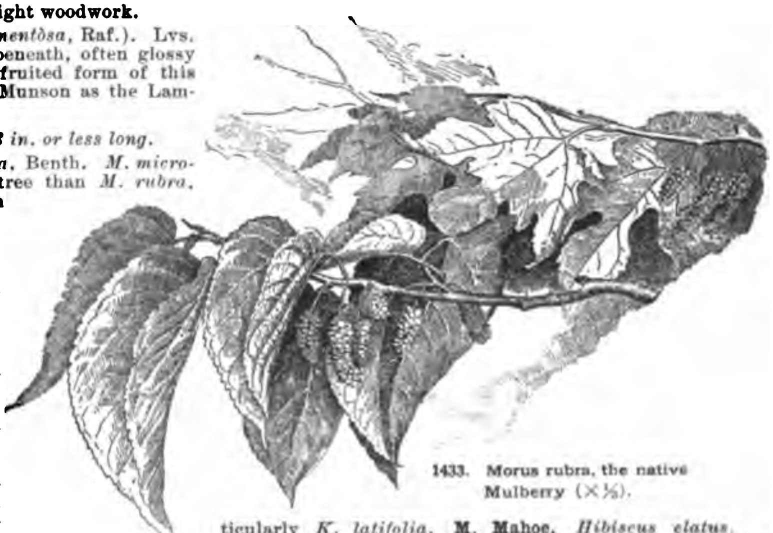
1432. Leaf of Morus alba at B; of M. multicaulis at A.

MOSS PINK. *Phlox subulata*

MOTHER OF THOUSANDS. *Linaria Cymbalaria;* also Hen-and-chickens daisy (Bellis), and *Saxifraga sarmentosa.*

MOULDS. The term Mould is generally applied to any small fungous growth which appears on decaying organic matter, such as fruits, both fresh and preserved, vegetables, etc. The Moulds are very simple fungi producing immense numbers of spores, a fact which accounts for their presence everywhere, in the air, in dust, and on all exposed bodies. As a rule these fungi are not directly injurious to plants; they are normally saprophytes and perform a great service in disorganizing organic matter which would otherwise accumulate on the earth. A few of the species may become parasitic. Thus, species of Botrytis often attack lettuce in forcing-houses which are too close and damp. Carnation buds and violet plants are also frequently injured by Botrytis. The mould-like growths occurring on boards in damp cellars or in greenhouse benches are sterile mycelia of higher fungi. These do not attack plants, but sometimes, as in the case of violets, grow over and smother the plants. (See also *Diseases, Fungi.* HEINRICH HASSELBRING.

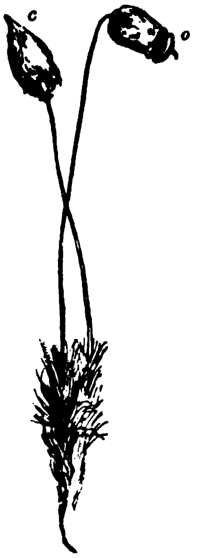
MOUNTAIN ASH. *Pyrus Aucuparia.* **M. Cherry.** *Prunus angustifolia.* **M. Ebony.** *Bauhinia.* **M. Holly.** *Nemopanthes fascicularis.* **M. Laurel.** *Kalmia*, particularly *K. latifolia*. **M. Mahoe.** *Hibiscus elatus*. **M. Mahogany.** *Cercocarpus*. **M. Mint.** *Pycnanthemum*. **M. Rose.** *Antigonon*.


1433. Morus rubra, the native Mulberry (× ½).

MOURNING BRIDE. See *Scabiosa*.

MOVING PLANT. *Desmodium gyrans*.

MUCÙNA (Brasilian name). *Leguminòsæ.* Between 20 and 30 mostly twining plants, widely distributed in the tropics, one of which is somewhat cultivated as a forage plant. The genus is allied to Glycine, which includes the Soy Bean. The lvs. are large and 3-foliolate: fls. long or oblong, large, usually dark purple (sometimes yellowish) but turning black when dried, the corolla much longer than the narrow-lobed calyx; the keel long, boat-shaped and usually twice or thrice longer than the obtuse standard and also longer than the wings: stamens diadelphous (9 and 1) the anthers not uniform in kind: pod usually hairy, bristly or pubescent, containing globular pea-like seeds. The Mucunas are either annuals or perennials. The fls. are borne in axillary clusters, and the pods are usually long and beset with stinging hairs.



1434. A true moss—Polytrichum commune. Nat. size. (See p. 1035.)

prùriens, DC. (*Dòlichos prùriens,* Linn. *D. multiflòrus,* Hort.). Cowitch. Cowage. Fig. 1435. Annual twiner, the branchlets somewhat appressed-hairy and the lvs. more or less silky-hairy beneath: petioles usually longer than the lvs.: lfts. ovate or the lateral ones rhombic-ovate, obtuse but apiculate: fls. several to many, dull purple, 1½-2 in. long, in more or less drooping racemes: pods f-shaped (the ends curved in opposite directions), 2-4 in. long, ribbed, densely brown-or gray-bristly.—Tall-twining vine, common in the tropics of both hemispheres. The hairs or bristles on the pods are dislodged by the touch and they are very irritating to the skin, often raising blisters. These hairs also constitute a remedy for intestinal worms, it being supposed that they kill the worms by irritating or stinging them. It is a variable species.

Var. **ùtilis** (*M. ùtilis,* Wall.). Velvet Bean. Banana Bean. A cultivated form, differing in the mostly shorter pods, which are only velvety (not bristly-hispid). Widely grown in the tropics.—Of late it has attracted attention in the Gulf states as a forage and green-manure crop, but its use is still in the experimental stage in most places. Cattle have been fed successfully on the meal made of the beans ground in the pod, but people have been made sick by eating the green cooked beans, and chickens have been killed by both raw and cooked beans. Because of its vigorous growth, the Velvet Bean promises well as a soil renovator, as the cow-pea does, although it can not be be grown so far north as that plant. It is a good ornamental plant, growing 10-20 ft. high when supplied with support. The handsome globular beans (⅜-½ in. diam.) have markings which suggest the castor bean.

capitàta, Sweet. Cult. in India and Japan (A.G. 13:728) as a household vegetable (as a shell bean), but doubtfully distinct from the above: fls. usually fewer on erect or ascending peduncles: pod mostly larger and flatter, less hairy and becoming nearly or quite glabrous at maturity; bean larger, somewhat flattened.—Not yet reported in this country.

nívea, DC. Also cult. in India, and perhaps a cultural race of *M. pruriens*: fls. white: pod large, black, becoming glabrous.

L. H. B.

MUEHLENBÉCKIA (after Dr. Muehlenbeck, a Swiss physician). *Polygonàceæ.* A rather small genus of climbing or erect, usually slightly shrubby plants, all inhabitants of the south temperate zone: lvs. alternate, with sheathing stipules at the base: fls. unisexual, small, fascicled in the leaf-axils; perianth with 5 nearly equal lobes; stamens 8: ovary 1-celled, 1-ovuled: styles 3: akene obtuse or acute, 3-angled, crustaceous, about equaling the succulent perianth. All greenhouse plants, very various in appearance.

compléxa, Meissn. A twining or drooping, somewhat shrubby plant: stem slender and much-branched, glabrous except when very young: lvs. very small, 3-5 lines long, light green, about equaling the petiole, mostly fiddle-shaped, rarely hastate; sheaths small, tubular, deciduous: fls. 1-6, in somewhat racemose, pubescent clusters, green and inconspicuous: fr. with a succulent, transparent, whitish, persistent perianth. New Zealand.—A graceful greenhouse basket plant, but may also be made to twine. Fruit clusters glistening, showy. Is sometimes called Polygonum by florists.

platyclàdos, Meissn. (*Coccóloba platyclàda,* F. Muell.). A very interesting erect, shrubby plant, with broad, flat, ribbon-like, glossy, delicately striate branches, replacing the lvs., which are scanty or entirely wanting: lvs. membranous, oblong-lanceolate, sometimes hastate: bracts and stipules very short: fls. white, in few-fld. clusters: akenes included in the fleshy perianth, which at maturity is bright red or at length deep purple and quite showy. Solomon Isls. B.M. 5382.—Frequently grown in greenhouses because of the odd flat stems and showy fruit.

M. adpréssa, Meissn. Large, diffuse, bushy plant, with small pink fls. in paniculate spikes: lvs. up to 2 in. long, broadly oblong, often cordate, glabrous. Australia. B.M. 3145 (as Polygonum). Cult. in Europe.

K. M. Weigand.

MUEHLENBÉRGIA (Dr. H. Mühlenberg, who wrote a work upon American grasses in 1817). *Gramíneæ.* About 60 species, mostly American. Spikelets 1-fld. The following is offered by one dealer in native plants.

glomeràta, Trin. An erect perennial, with rather short appressed lvs.: panicle contracted and spike-like: empty glumes nearly equal, 1-nerved, extending into short awns: fl.-glume longer than empty glumes, except the awns. Wet ground, nearly throughout northern U. S.

A. S. Hitchcock.

MUGWORT. *Artemisia vulgaris.*

MUÍLLA (an inversion of Allium). *Liliàceæ.* A genus of one species, an unimportant plant advertised by one specialist in Pacific coast bulbs. It has a slender scape 3-12 in. high, bearing early in the year an umbel of 5-15 greenish white fls., each about ½ in. across. The genus is close to Allium, but instead of a true bulb it has a fibrous-coated corm, and also lacks the onion-like odor. Generic characters are: perianth subrotate, persistent, of 6 nearly equal, slightly united segments: filaments slightly thicker at the base: ovules 8-10 in a cell: style club-shaped, persistent and at length splitting.

marítima, Wats. Lvs. several, not sheathing at base, scabrous, as long as the scape. Calif., Nev.

MUKIA. See *Melothria.*

MULBERRY. Discussed under *Morus.* **French M.** *Callicarpa Americana.* **Indian M.** *Morinda.* **Paper M.** *Broussonetia.* The wild *Rubus odoratus* is improperly called Mulberry in some parts of the country.

MULCHING has four general objects: (1) to conserve moisture in the soil by preventing or hindering evaporation; (2) to protect plants from winter injury; (3) to keep the surface of the soil loose and friable; (4) to add plant-food to the soil.

The moisture which is available to agricultural plants is held in the soil by means of capillary attraction. The soil may be conceived to be full of irregular capillary tubes which have a general vertical direction. The upper ends of these tubes or spaces are in contact with the atmosphere, and they are constantly giving off moisture into the air. If the upper ends of these tubes are covered, as with a board or a mulch, the evaporation into the atmosphere is relatively slight. If they are covered with a mulch of ashes or sawdust, a similar result may be attained. This dry earth-mulch may be made on the spot by tilling the upper two or three inches of soil. The philosophy of summer tillage is to prepare and to maintain this mulch of soil, thereby interposing a relatively non-capillary stratum between the moist soil and the air. This earth-mulch may itself be dust-dry, but it protects the soil beneath. There is more or less evaporation into the interstices of the earth-mulch itself, and some of the moisture ascends through the mulch and escapes into the atmosphere; but it has been found by long experience and by experiments that the earth-mulch greatly lessens evaporation. The frequent stirring of the surface soil in summer is said to make the land moist; as a matter of fact, it keeps it moist. When it is impracticable to keep a surface mulch by means of tillage with horse tools or a rake, it is sometimes advisable to use straw or manure. Mulching newly set trees is often desirable when it is not possible to till the land or not practicable to water them. The ideal mulch to conserve moisture, however, is the loose soil, since the stirring of the soil not only affords the mulch but also sets at work various chemical and biological forces which make the plant-food more available.

All herbaceous plants and most shrubs are benefitted by a mulch in the fall, no matter how hardy they may be in the given locality. Nature's mulch is the debris of fallen leaves, grass and other litter. The autumn leaves which blow into the borders and the clumps of shrubbery, afford the very best winter mulch; and yet it is a common practice to scrupulously collect and burn these leaves in the fall, and then if the plants are mulched to apply manure. This is doubtful wisdom. The herbaceous border will be benefitted by a loose, open mulch, 6 to 10 inches deep. If the mulch is of such character as to become very hard and dense, and to hold too much water, it may be injurious. Leaf-mold, loose muck or peat, autumn leaves mixed with some litter which will prevent them from packing too hard, manure which is not too strong in nitrogen and potash, fine straw, sawdust, shavings, pine needles, evergreen boughs—these are some of the materials which may be used as a mulch to good advantage. If the mulch has thoroughly decayed by spring, it may be left on the land and it will make a fine loamy covering which will be much like the vegetable mold found in the woods. Too often the passion for cleanness sacrifices the welfare of the border. Persons will collect and burn every stray autumn leaf, but will not notice many kinds of dirt which are really objectionable.

The mulch keeps the surface of the soil loose and mellow because it protects it from the beating of heavy rains and the weight of snow. The vegetable fiber which works into the surface also prevents the particles of heavy clay soils from running together or puddling. Soils which are covered with a mulch do not bake.

Whenever the mulch contains soluble plant-food, the soil receives the leachings and is enriched. Stable manure is an ideal mulch for enriching the soil, but if the manure is fresh and strong, it is likely to injure the crowns of some plants. L. H. B.

1435. Mucuna pruriens, or Cow-Itch (× ⅓).

MULLEIN. See *Verbascum.* **Mullein Pink.** *Lychnis Coronaria.*

MURRÀYA (J. A. Murray, 1740–1791, professor in Göttingen). *Rutàceæ.* Trees or shrubs without thorns: lvs. pinnate; lfts. ovate, rhomboid or elliptical-lanceolate, cuneate or oblique at base: fls. comparatively large, solitary and axillary, or in terminal corymbs or axillary cymes; sepals 5, ovate or lanceolate, united only at the base or in the lower third; petals 5, linear-lanceolate, free, imbricate; stamens 10, free, inserted on an elongated disk, the alternate shorter: ovary ovate, 2–5-celled narrowed into a long and finally deciduous style; stigma capitate; ovules solitary or 2, superimposed or collateral in each cell: fr. a small elliptical or round berry. Four species in Indo-Malay region.

exótica, Linn. ORANGE JESSAMINE. A very variable evergreen shrub or small tree: young branches pubescent: lvs. glabrous, 3–8-foliolate; lfts. oblique, short-petioled, about 1 in. long, obovate or elliptical, entire, shining above: fls. campanulate, ⅓ in. in diam., pure white, very fragrant: ovary 2-celled: fr. a small berry, elliptical, reddish, glandular-dotted, 1–2-seeded. India, China, Australia and the Pacific islands.—A tender tropical shrub, with dense foliage and of upright-bushy habit. Cultivated to some extent on lawns in southern Fla. and S. Calif., and in hothouses. A fine ornamental pot-plant, blooming when small. *Murraya exotica* "needs ample pot room and a liberal supply of plant-food. An annual application of bone-meal when repotting in February intensifies the color of the foliage, increases the size of the flowers, and causes it to bloom more frequently. When properly treated, the first crop of flowers usually appears here [Georgia] during May, another during July, and this is succeeded at intervals of from four to six weeks until fall. For winter, give it the temperature of a cool greenhouse, but during summer it thrives best when given full sunshine outdoors." *P. J. Berckmans,* A.F. 11:1367 (picture).

Kœnigii, Spreng. Lvs. 10–20-foliolate, pubescent or rarely glabrous. Along the foot of the Himalayas in India.—A small, strong-smelling tree. The bark, leaves and roots of this species are used in India as a tonic.

elongàta, DC. Lvs. 4–6-foliolate, glabrous; lfts. 4–5 in. long, much longer and more lanceolate than any form of *M. exotica:* bark on slender branches pale yellow. Burma.

paniculàta, Jack. SATINWOOD or COSMETIC BARK TREE. Arboreous: corymbs few-fld. or fls. solitary.—The wood of this species is considerably used because of its strength and endurance and light yellow color. The bark is used as a cosmetic. By some considered to be a form of *M. exotica.*

H. J. WEBBER.

MÙSA (named after Musa, the physician of Augustus). *Scitaminàceæ.* BANANA. PLANTAIN TREE. Large herbaceous or slightly shrubby plants with immense undivided leaves, forming a very conspicuous feature in the tropical forests of the Old World, where alone it is native. Characterized by the elliptical pinnately-parallel-veined lvs. with the sheathing petioles forming a false stem-like structure: fls. unisexual, in clusters, each cluster subtended by a large, colored bract, and all arranged in a dense terminal panicle borne on a stalk rising through the center of the false stem; perianth of 6 parts, 5 of which are united in 1 piece, designated below for convenience as calyx, and 1 free, here termed the petal; perfect stamens 5: ovary inferior, 3-celled, many-seeded: fr. large, more or less elongated, indehiscent, pulpy or dry. Plants of great importance in the tropics, where the fruit is used for food. Bananas are imported into the U. S. in great quantities from Cuba and Central America, and are also grown in the Gulf states (see *Banana*). Several species are grown extensively in the North solely for decorative purposes. Latest monograph of the genus by Baker, Annals of Botany 7:205 (1893). K. M. WIEGAND.

The principal species grown for its fiber is *Musa textilis*. Its cultivation is confined almost entirely to the Philippine Islands, where it is grown in immense dense groves. The product of this fiber Banana is known in commerce as Manila hemp. This species is a very tall-growing one, reaching a height of 20 or more feet. It produces an inedible fruit filled with seeds, from which it is readily propagated. It is little known in this country.

As decorative plants in landscape gardening few subjects equal the choicer species of Bananas. The immense leaves arching out gracefully from the top of the "stalk," which is in reality a bundle of long leaf-stems so closely united as to form, for practical purposes, a real stem, give an effect of tropical luxuriance. As they are of really easy growth, their cultivation in temperate climates is on the increase. The smaller species, some of them with mottled or variegated foliage, are most useful for bedding purposes on a small scale.

Young plants may be obtained from nursery or florist firms in the spring or early summer and kept growing in pots in the conservatory or house until settled warm weather permits open-air planting. They should then be given considerable space in a well-enriched bed, having a situation sheltered from the prevailing winds and where water can be applied during dry weather. The Banana is impatient of shade, doing its best in strong sunshine. Heavy winds tear the large leaves, and hence a sheltered location is best for preserving the beauty of the foliage. By autumn the plant will be large, and if desired to carry it on to fruiting, it should be carefully lifted into good soil in a large tub for growth under glass during winter. By the following summer it should be of sufficient age and size to bloom and fruit in the open ground. The plants may be stored in a light, frost-proof cellar during the winter, but by this means the foliage will be lost and the plant suffer a severe check. When it is desired merely to have their foliage for ornamental purposes, and fruiting the plant is not specially desired, the heavy tuberous roots may be deprived of tops and stored in dry sand through the winter. In the spring these will throw up shoots, if given heat and moisture in the greenhouse or hotbed. E. N. REASONER.

INDEX.

Basjoo, 3.
Cavendishii, 1.
Champa, 4.
Chinensis, 1.
coccinea, 8.
Dacca, 4.
Ensete, 5.
Japonica, 3.
Martini, 2.
orientum, 4.
palustris, 4.
paradisiaca, 4.
rosacea, 10.
rubra, 4.
sanguinea, 9.
sapientum, 4.
seminifera, 6.
Sinensis, 1.
Sumatrana, 7.
Troglodytarum, 4.
Uranoscopos, 4.
vittata, 4.
zebrina, 6.

A. *Fruit edible, seedless (except rarely Nos. 3 and 4): petal ovate, entire.*
  B. *Lvs. 2–3 ft. long: plant dwarf, 4–6 ft. high: fr. 6-angled: fls. 1 in. long*...................... 1. **Cavendishii**
  BB. *Lvs. 5–9 ft. long: plant taller, 8–30 ft.: fr. 3–5-angled: fls. 1½–2 in. long.*
    C. *Foliage very glaucous beneath, firm: fls. rose-red*.......... 2. **Martini**
    CC. *Foliage green on both sides (except one var. of No. 4), thin: fls. yellowish white, except in two forms of No. 4.*
      D. *Fls. 2 in. long; bracts oblong, brownish: petal equaling the calyx: male fls. persistent*............ 3. **Basjoo**
      DD. *Fls. 1½ in. long; petal half the length of calyx: bracts lanceolate: male fls. deciduous*.................. 4. **sapientum**
AA. *Fr. not edible: pulp scanty or none.*
  B. *Plant tall (30–40 ft.), not stoloniferous: petal 3-toothed: false-stem bottle-shaped: fr. very seedy*......................... 5. **Ensete**
  BB. *Plant low (2–8 ft.), stoloniferous: petal linear (ovate in No. 6), entire: false stem cylindrical.*
    C. *Fls. about 12 to a bract; petal ovate*.................... .... 6. **seminifera**
    CC. *Fls. only about 3–4 to a bract; petal linear.*
      D. *Lvs. large, 5–6 ft. long: fr. with stipe ½–1 in. long*... 7. **Sumatrana**
      DD. *Lvs. smaller, 2–4 ft. long: fr. nearly sessile.*
        E. *Bracts bright red*........ 8. **coccinea**
        9. **sanguinea**
        EE. *Bracts pale blue or reddish lilac*.............10. **rosacea**

1. **Cávendishii**, Lamb. (*M. Sinénsis*, Sagot. *M. Chinénsis*, Sweet). CHINESE DWARF BANANA. DWARF JAMAICA. Stoloniferous: whole plant 4–7 ft. high: false stem cylindrical, 3–4 in. in diam.: lvs. conspicuously spreading, oblong, 2–3 ft. by 1 ft.; petioles short and stout; blade when young spotted and blotched with red, in age rather glaucous: panicle drooping: bracts ovate, dark reddish brown: male fls. persistent; calyx yellowish white; petal one-half as long: panicle very large, the fruits 200–250, small, 4–5 in. by 1½ in. or more, yellow, slightly curved, broad, obtuse, narrowed to the sessile base; skin thick, flesh delicate and fragrant. Southern China. Int. from Mauritius in 1829. Gn. 32, p. 243; 40, p. 263; 44, p. 496; 50. p. 161. G. C. III. 22:167.—Stands more cold than most Bananas, and its dwarf growth readily allows of protection. Good for planting in the North; good, also, for shipping. Grown extensively along the coast of the southern states and in the West Indies.

2. **Mártini**, Hort. Similar in habit to *M. sapientum*: lvs. oblong, long-petioled, quite thick and not easily broken by the wind; veins and stem commonly reddish: fruit rather small, yellowish. Int. from the Canary Isls. R.B. 18, p. 107.—A foliage plant good for exposed places.

3. **Basjoò**, Sieb. & Zucc. (*M. Japónica*, Hort.). JAPANESE BANANA. Stoloniferous: whole plant 12–18 ft. high: false stem cylindrical, 6–8 in. in diam.: lvs. oblong, thin, 6–9 ft. by 1½–2 ft.; petiole about 1 ft. long: peduncle 1 ft. long: panicle dense, nodding: bracts dull brown: petal nearly equaling the calyx: fr. 30–60, oblong, pointed, 3 in. long, gradually narrowed to a sessile base, usually containing a few seeds. Liu-Kiu archipelago, cult. in Japan. B.M. 7182. R.B. 22, p. 152. R.H. 1896, p. 203. Gn. 55, p. 3.—Decorative; valuable because of its resistance to cold; may be planted at the North.

4. **sapiéntum**, Linn. COMMON BANANA. Figs. 187, 188. Stoloniferous: plant 20–30 ft. high: false stem cylindrical, 4–6 in. in diam.: lvs. oblong, thin, bright green, 4–7 ft. by 1½–2 ft.; petiole slender, 1–1½ ft. long: panicle often 4–5 ft. long: bracts ovate-lanceolate: fls. 1½ in. long: fr. in the typical form, 3–4 in. by 1½–2 in., forming 3–4 bundles of about 12 each, rounded above, narrowed to a sessile base, bright yellow; flesh good, seedless. Native in India and E. Indian Isls.—Widely cult. throughout the tropics for the excellent fruit, and also more rarely for the fiber, which is inferior to that of *M. textilis*. Most of the commercial Bananas are obtained from the numerous varieties of this species. The Ori-

noco, Horse or Hog Banana, is probably very near the typical form of this species. It is very hardy, and much grown in Gulf states: fr. 6–7 in. long, not good unless ripened on the plant. The Fig Banana resembles var. **Champa**, but small fruit purplish: dark lvs. and stem often blotched with black. Not hardy.

Var. **Troglodytàrum**, Hort. (*M. Troglodytàrum*, Linn. *M. Uranoscòpos*, Rumph, not Seem.). Rather dwarf: lvs. narrow-oblong: bracts greenish: panicle in fr. erect: fr. small, 2–3 in. long, nearly globular, reddish yellow or orange, rarely with a few seeds; flesh yellow, sweet and mawkish. India and Pacific Isls., rarely cult. in U. S.

Var. **Dácca**, Hort. (*M. Dácca*, Horan. *M. palústris*, Hort.?). DACCA BANANA. Rather dwarf: stem glaucous: lvs. pale green, glaucous beneath; petioles with red margins: fr. yellow, 4 in. long by 2 in. wide, its tip and base bright green; flavor good; skin thick.—Tender, not good for cool climates.

Var. **Chámpa**, Hort. (*M. Chámpa*, Hort. *M. oriéntum*, Hort.). HART'S CHOICE. LADY FINGER, or GOLDEN EARLY BANANA. CHUMPA. Stem and midrib of leaf tinged with red: fr. pale straw-yellow, about 6 in. long; skin very soft and thin; flesh luscious and delicate in flavor, ripens quickly. Hardy in cool climates. Best of all for growing in Florida. Much grown in W. Indies.

Var. **paradisiaca**, Hort. (*M. paradisiaca*, Linn.). PLANTAIN BANANA. COOKING BANANA. ADAM'S FIG. Male fls. more persistent: fr. 40–80 on a panicle, very large, 7–14 in. long, cylindrical, yellow, acutish; pulp firm and less saccharine, not very good unless cooked: lvs. 5–7 ft. and petiole 2 ft. long. India. R.H. 1888, p. 69. L.B.C. 7:684.—Cult. everywhere in tropics, especially in Cuba. Most commercial Bananas are of this variety. The Martinique Banana is probably merely a form with slightly smaller fruits (7–8 in. long). Immense quantities grown in W. Indies and Cent. Amer. Fine for shipping.

Var. **rùbra**, Hort. (*M. rùbra*, Firming). BARACOA BANANA. RED JAMAICA BANANA. RED SPANISH BANANA. Stem, petiole, fls. and midrib of leaf dull red: fr. large, 7–9 in. long at first, dark red, ripening to a yellowish red, of very good quality.—This is the red Banana of commerce, formerly imported in large quantities from the W. Indies. Plant very large and stout, with erect lvs., and is one of the finest for decorative purposes, although not very hardy. The Golden Banana is intermediate between this and var. *Champa*: fr. golden yellow or reddish, 8–9 in. long, blunt.

Var. **vittàta**, Hook. Rather dwarf in habit: lvs. and the long fruits copiously striped with white and often also rose; spathes bright red inside. B.M. 5402.—Very decorative.

5. **Ensète**, Gmel. ABYSSINIAN BANANA. Fig. 1436. One of the largest species, very luxuriant: lvs. oblong, acutish, bright green, up to 20 ft. by 3 ft.; petiole short and broad; peduncle short; panicle nearly globose: bracts ovate, dark claret-brown: fls. whitish, 1½–2 in. long, 2-ranked, 20 or less in each rank; calyx strap-shaped; apex 3-lobed; petal short, central cusp long-linear: fr. coriaceous, dry, 2–3 in. long: seeds 1–4, black, glossy, nearly 1 in. broad. Abyssinia. G.C. II. 15:435; 21:19; III. 16:696. Gn. 47, p. 5; 48, p. 406. B.M. 5223. R.H. 1888, p. 32. V. 5:53. F.E. 11:470.—Most commonly cult. of all decorative Bananas, and probably the finest; also most hardy of all cult. forms, growing freely during the summer. Seeds germinate easily in hotbed.

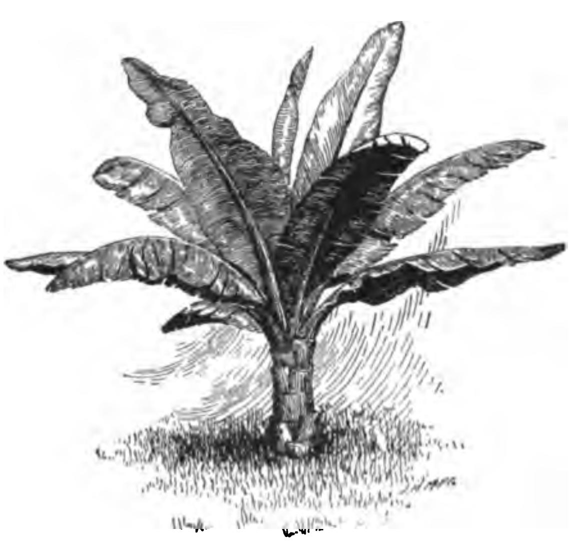
6. **seminifera**, Lour. The typical form is not in the trade. Var. **zebrina**, Hort. (*M. zebrina*, Hort.). Very similar to *M. sapientum* in vegetative characters, but much smaller: axis of the panicle velvety: fr. small, oblong, full of seeds and not edible, yellowish or greenish in color: lvs. usually purple below and copiously blotched or striped with black or dark purple above.—A very fine ornamental variety.

7. **Sumatràna**, Becc. False stem 3 ft. high: lvs. oblong, 5–6 by 1½ ft., glaucous, blotched with claret-brown; petiole slender: peduncle hairy: panicle drooping, 1–1½ ft. long: male fls. deciduous: bracts short and rounded: female clusters few, distant: calyx 1 in. long: fr. cylindrical, curved, 2–3 in. by ½ in., narrowed suddenly to a slender stipe. Sumatra. I.H. 27:375.—Used for decorative purposes.

8. **coccinea**, André. False stem slender, 4–5 ft. by 2–3 in.: lvs. small, oblong, 2–3 ft. by 6–9 in.; petiole long and slender: panicle dense, erect, 6 in. long: female clusters few: bracts lance-oblong, bright red, tipped with yellow: calyx yellow, 1 in. or more long: seeds very small, oblong, rarely produced in cult. S. China. B.M. 1559. L.B.C. 5:475.—Very showy.

9. **sanguinea**, Hook. f. False stem slender, 4–5 ft. high: lvs. oblong, 2–3 ft. long, thin, bright green; petiole slender, 1 ft. long: panicle at first erect, finally drooping: female clusters 2–6, each 2–3-fid.: male clusters few, dense: bracts lanceolate, somewhat persistent: bright red: calyx bright yellow, 1½ in. long: fr. oblong-trigonous, 2 in. long, rather pulpy, pale green, variegated with red: seeds angled, small, black, tubercled. Assam. B.M. 5975.—Decorative and showy.

10. **rosàcea**, Jacq. False stem 3–5 ft. high, 3–4 in. in diam.: lvs. narrow, linear-oblong, firm, 3 ft. long, 9 in. wide, purplish beneath; petiole long and slender, panicle drooping or erect, about 1 ft. long: bracts ovate-lanceolate; rosy purple: male clusters more numerous than the female, deciduous: calyx yellow, 1 in. long: fr. oblong, obscurely 4–5-angled, yellowish green, 2–3 in. long; pulp very scanty and scarcely edible: seeds 2 lines in diam., black, tubercled, rare in cult. India. B.R. 9:706. L.B.C. 7:615.—Int. into California.



1436. Musa Ensete.

M. Fèhi, Vieill. (M. Seemanii, F. Muell.). Similar to M. sapientum. Lvs. larger and firmer: fr. 5–6 in. long, straight, yellow, edible, seedy. Cult. in Europe. G. C. III. 8: 182.—*M. rùbra*, Hort., differs from M. coccinea in its short petal (one-half length of calyx). Cult. in Europe. B.M. 7451.—*M. supérba*, Roxb. Similar to M. Ensete: trunk often 7–8 ft. in circumference at base: panicle drooping, one-third length of stem: calyx of 3 loosely cohering parts. Cult. in Europe. B.M. 3849, 3850. R. H. 1877, p. 277; 1888, p. 33. F. 1873, p. 273.—*M. téxtilis*, Neé. MANILA HEMP. Stem cylindrical, 20 ft. or more high: lvs. glaucous beneath, oblong, firm: petal long: fr. on drooping axis, green, 2–3 in. long, narrowed to a short, stout pedicel, not edible, filled with seeds. Most important of cordage plants. Immense quantities exported from the Philippines. Int. by Div. of Pomology, U. S. Dept. of Agric., in 1889, but no longer advertised.

K. M. WIEGAND.

MUSCÀRI (Latin name referring to the musky odor of *M. moschatum*). *Liliàceæ*. GRAPE HYACINTHS are charming, hardy, spring-blooming bulbs (see Fig. 1439). They are something like a hyacinth, but the clusters are smaller, and the individual fls. are smaller and of different shape. The fls. are more or less urn-shaped, constricted at the mouth and have 6 small teeth instead of prominent perianth-segments, as in the true hyacinth. The common Grape Hyacinth, which every garden lover knows, is called *M. botryoides*, which means "like a bunch of grapes." Everybody who has any ground for gardening should have some bulbs of this common kind, both blue-flowered and white. All the other kinds described below are fanciers' plants, interesting chiefly to skilled amateurs. Among them the most remarkable is the Feathered Hyacinth (*M. comosum*, var. *monstrosum*), which is a mass of lilac shreds (see Fig. 1438). Any species of Muscari is likely to have some sterile fls. at the top of the cluster which are often of a different color, but in the Feathered Hyacinth there is no suggestion left of the urn-shaped flower, sterile and fertile fls. all being cut into fine strips. This attractive plant has lately been sold for fancy prices by a few progressive florists.

All Grape Hyacinths are very much alike and are very interesting, botanically, horticulturally and from the artistic point of view. There are perhaps 40 species in Europe, western Asia and northern Africa. The group needs botanical revision badly. The chiefly literary sources are Baker in Jour. Linn. Soc. vol. 11 (1871), and in G.C. II. 9:798 (1878); also Boissier's Flora Orientalis. The width of the lvs. is an important character, and Baker's measurements seem to refer to herbarium specimens. Live plants should be wider. (A line is a twelfth of an inch.)
W. M.

Grape Hyacinths are neat little early flowering bulbous plants, good-sized colonies of which give dainty effects in the border from February to May. There are numerous species of these, flowering at different times. They are mostly dark purple in color, either self-colored or tipped with white. There are also a few white and yellow forms, and several species with true blue flowers, the rarest color among flowers, though this would never be discovered in catalogues. *M. Szovitsianum*, one of the true blue forms, is quite the prettiest of the genus. The plant known to the trade as *M. lingulatum* or *Hyacinthus azureus* has the true blue of *M. Szovitsianum*, and is fully a month earlier. The usual forms grown in gardens are mostly blue (purple) and white forms of *M. botryoides*. *M. conicum* is very dark. The Dutch catalogues offer numerous kinds to suit purses in all stages of decrepitude. Muscari offer no difficulties in cultivation. A medium soil perhaps suits them best, but they are usually thrifty growers, and persistent in the garden if foliage is allowed to ripen. They mostly make offsets freely, and produce abundant seed.
J. N. GERARD.

INDEX.

album, 4.
atrocæruleum, 15.
Aucheri, 6.
botryoides, 4.
carneum, 4, 12.
cæruleum, 4.
comosum, 2, 15.
commutatum, 15.
compactum, 17.
conicum, 8.
dipcade, 1.
flavum, 1.
Græcum, 3.
grandiflorum, 4, 12.
Heldreichii, 5.
latifolium, 13.
Lelievrei, 4.
leucophæum, 4.
lingulatum, 6.
macrocarpum, 1.
major. 1.
majus, 4.
micranthum, 9.
minor, 1.
moschatum. 1.
monstrosum, 2, 15.
neglectum, 14.
pallens, 11.
pallidum, 4.
paradoxum, 7.
plumosum, 2, 15.
polyanthum, 16.
racemosum, 12.
suaveolens, 1.
Szovitsianum, 10.

Subgenus I. MOSCHARIA. Perianth urn-shaped, but with a relatively long-tubular base; segments minute, even for the genus, roundish, spreading and thickened on the back....... 1. **moschatum**

Subgenus II. LEOPOLDIA. Perianth obovoid-urn-shaped, grooved above, 3–4 lines long; segments triangular, reflexed, not thickened on the back: raceme loose, and longer than in the next. Particularly characterized by the conspicuous bearded appearance of the sterile fls..................... 2. **comosum**
3. **Græcum**

Subgenus III. BOTRYANTHUS. Perianth more or less urn-shaped, grooved or not above, 1–2 or rarely 3 lines long; segments triangular, usually reflexed: raceme dense, 1–2 in. long. Sterile fls. inconspicuously bearded or hardly at all.

A. *Fertile fls. a little longer than broad, i. e., obovoid-globose.*
  B. *Lvs. 3–4: fls. 12–20*........... 4. **botryoides**
  BB. *Lvs. 5–6: fls. 8–12*............ 5. **Heldreichii**
  BBB. *Lvs. 2–3: fls. 6–10*............ 6. **lingulatum**
AA. *Fertile fls. 1½ times as long as broad, i. e., obovoid-oblong.*
  B. *Color of fls. black-blue* .... 7. **paradoxum**
  BB. *Color lively dark lilac or blue.*
    C. *Lvs. 3–4 lines broad* .... 8. **conicum**
    CC. *Lvs. 1–2 lines broad.*
      D. *Fls. violet, fragrant*..... 9. **micranthum**
      DD. *Fls. blue, faintly odorous*10. **Szovitsianum**
  BBB. *Color nearly white* ....11. **pallens**
AAA. *Fertile fls. twice as long as broad, i. e., obovoid-cylindrical.*
  B. *Lvs. almost cylindrical (subterete)* ....12. **racemosum**
  BB. *Lvs. oblanceolate*.............13. **latifolium**
  BBB. *Lvs. lorate, i. e., strap-shaped*.14. **neglectum**
15. **commutatum**
16. **polyanthum**
17. **compactum**

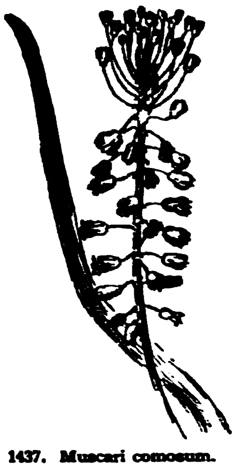
1. **moschàtum**, Willd. (*M. suavèolens*, Fisch.). MUSK HYACINTH. Lvs. 5–6, 1 ft. long, ½–¾ in. wide: raceme loose, 1–3 in. long: fls. 20–50, blue. Asia Minor. B.M. 734. Gn. 26, p. 137.—Has the odor of musk. Vars. **màjor** and **minor** are advertised. *M. dipcade major* and *minor* have appeared in the catalogue of J. M. Thorburn & Co. since 1878, but these names are not in Index Kewensis. Thorburn & Co. write that this is the Nutmeg or Musk Hyacinth, *Muscari moschatum*, and that *M. dipcade* still appears in Dutch catalogues.

Var. **flàvum**, Lam. (*M. flàvum*, Van Tubergen. *M. macrocàrpum*, Sweet). Fls. yellowish (Van Tubergen says clear yellow). B.M. 1565.

2. **comòsum**, Mill. Fig. 1437. Lvs. 3–4, 1–1½ ft. long, ½–1 in. wide: raceme loose, 6–12 in. long, 40–100-fld.: lower fls. fertile, olive, tipped brown, borne on long horizontal pedicels: upper fls. sterile, blue or violet, borne on long up-curved pedicels, making a corymbose cluster. Mediterranean region, Orient. B M. 133 (as *Hyacinthus comosus*).—An interesting form, but rare in cult., being greatly surpassed in popularity by

Var. **monstròsum**, Hort. FEATHERED HYACINTH. Fig. 1438. All the fls. sterile, and cut up into fine shreds. Gng. 7:290. A.F. 14:1286. Gn. 26, p. 137.—A charming and novel plant. Also called Fair-haired or Tasseled Hyacinth, and Shredded Lilac. Sold also as *M. monstrosum*, *M. plumosum*, *M. plumosum monstrosum*, etc. For other trade synonyms, see under *M. commutatum*.

3. **Græcum**, Heldr. Differs from *M. comosum* in having its sterile fls. in a short, dense, conical spike, the pedicels of which are very short. Greece.



1437. Muscari comosum. (Adapted from Botanical Magazine.)

4. **botryoides**, Mill. COMMON GRAPE HYACINTH. Fig. 1439. Lvs. linear-lorate, 3–4 lines wide: scape 6–9 in. long: fls. pale blue, odorless. Eu., Orient. B.M. 157 (as *Hyacinthus botryoides*). A. F. 13:1197. Gn. 26:453. R.B. 20:3.—The following varieties are offered: *album*, *carneum*, *cæruleum*, *leucophæum*, *Lelievrei*, *majus*, *pallidum* and *pallidum grandiflorum*. These range from white through flesh-color to sky-blue.

5. **Héldreichii**, Boiss. Lvs. linear-filiform, subterete, 1½ lines wide: scape 4–6 in. long: fls. amethyst-colored, with conspicuous white teeth. Greece. Gn. 26:453.

6. **lingulàtum,** Baker (*M. Aùcheri*, var. *lingulàtum*, Boiss.). Lvs. 3 lines wide: raceme ovate. Asia Minor.—According to Index Kewensis this is a good species, but J. N. Gerard says the plant sold under this name is the same as *Hyacinthus azureus*.

1438. Muscari comosum, var. monstrosum.
(Adapted from Gardening.)

7. **paradóxum,** C. Koch. Lvs. 3, ½–¾ in. wide. Armenia.

8. **cónicum,** Baker. Lvs. about 6, narrower: fls. violet-blue. Habitat unknown. Gn. 51:1106 (?).—Van Tubergen says fls. black-blue.

9. **micránthum,** Baker. Fls. bright violet. Habitat unknown.

10. **Szovitsiànum,** Baker. Fls. bright blue, considerably larger (⅛ in. across, but only 1-12 in. across in *M. micranthum*). Persia, Caucasus. B.M. 6855.

11. **pállens,** Fisch. Lvs. numerous, filiform: scape 3–5 in. long: raceme 12–20-fld.: fls. white or nearly so. Caucasus, Iberia.

12. **racemòsum,** Mill. Lvs. 5–6, 5–6 in. long, 1–1½ lines thick: fls. odorous, dark blue. Mediterranean, Caucasus. B.M. 122 (as *Hyacinthus racemosus*).—Vars. *carneum* and *grandiflorum præcox* are offered.

13. **latifòlium,** J. Kirk. Lvs. always solitary, ¾–1 in. wide: sterile fls. 6–10, much paler than the others. Phrygia.

14. **negléctum,** Guss. Lvs. numerous, 9–12 in. long, 1½–2 lines thick: fls. odorous, dark blue. Mediterranean region. Gn. 26:453.—This differs from *M. commutatum* and *M. polyanthum* in having the segments of the perianth triangular and reflexed. *M. neglectum multiflorum* and *M. neglectum Atlanticum* are trade names. See supplementary list under *M. Atlanticum*.

15. **commutàtum,** Guss. Lvs. 5–6, 5–6 in. long, 1½–2 lines wide: fls. odorless, dark blue; segments very short, not recurved. Sicily.—Krelage advertises vars *atro-cæruleum, comosum, plumosum, plumosum monstrosum*, and *plumosum violaceum*. It is apparent that he regards *M. comosum* and its forms as varieties of *M. commutatum*.

16. **polyánthum,** Boiss. Lvs. 2–3 lines wide. Differs from *M. neglectum* and *commutatum* in having longer pedicels and the capsule a half smaller, not more than 2 lines wide.

17. **compáctum,** Baker. Described only as *Botryanthus compactus* in an obscure work, which states that the fls. are nearly black, with whitish teeth which are semi-orbicular, obtuse, spreading-recurved. Baker places *M. compactum* next to *M. commutatum*, in spite of the fact that the original description says the fls. are obovate. Baker adds that this *M. compactum* is the *M. neglectum* of some authors in part. The plant in the trade as *M. compactum* may be a variety of some common species, since Van Tubergen says the fls. are pale blue.

M. Argæi, little known botanically, is said to be extra good. In the trade, M. Atlanticum is given as a synonym. Baker said he could not distinguish M. Atlanticum from M. neglectum.—*M. Atlánticum.* Consult the preceding entry, M. Argæi.—*M. azùreum*, Hort., is said by Van Tubergen to be the same as Hyacinthus azureus, which in turn is referred to H. ciliatus by Index Kewensis. Gn. 36:713. Van Tubergen also advertises var. amphibolis (M. Freynianum).—*M. Motelàyi* is offered by Van Tubergen.

W. M.

MUSÈNIUM (a name for fennel, another plant of this family). *Umbelliferæ.* Three species of resinous perennial herbs in middle and western North America, stemless or branching, decumbent or ascending, 2–12 in. high. Lvs. pinnately decompound: fls. yellow or white, in compound umbels: fr. ovate or ovate-oblong; ribs 5, filiform, slightly prominent, with 2 or 3 oil-tubes in the intervals. Coulter and Rose, Revision of North American Umbelliferæ, 1888.

trachyspérmum, Nutt. (*M. divaricàtum*, var. *Hoòkeri*, Torr. & Gray). Decumbent: lvs., except the radical, opposite, bipinnatifid: fls. yellow: fr. scabrous. Spring. Saskatchewan to the Upper Missouri, the Platte, and S. W. Montana.—Procurable from dealers in western native plants.

MUSHROOM. While the word Mushroom is now often used as a general term for a large number of the higher fungi, chiefly those belonging to the Agaricini, it is by some limited to the common edible species in cultivation and which also grows spontaneously in lawns, pastures, etc. By others the word is employed for all edible species, while toadstool is employed to designate poisonous species; such persons usually make an incorrect application of these terms to many of the plants. The word is probably derived from the

1439. Muscari botryoides (× ½).

French word "mousseron," and is sometimes pronounced "mushroons," or "musheroons" by English-speaking people in America. Mushroom and toadstool are sometimes used as synonymous terms, especially in speaking of the group as a whole. It is difficult, therefore, to give either a satisfactory definition of the word Mushroom, or satisfactorily to limit the range of forms for which the name may be used. In a horticultural sense it is applied to *Agaricus campestris* (Fig. 1440) in cultivation, and since that is the plant with which we are first interested here, we may proceed at once to a description of its form, structure, development, etc., and follow with briefer descriptions and comparisons of a few of the many species belonging to this large group.

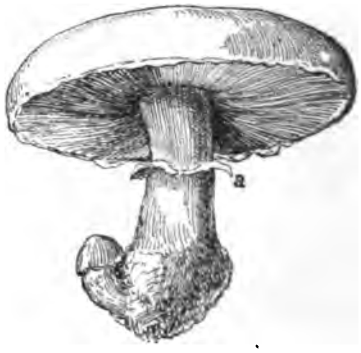
1440. The gardener's Mushroom, Agaricus campestris (× 1-5).

Form and Structure of Agaricus campestris.—The form of the common Mushroom is more or less umbrella-shaped, and is well represented in Fig. 1441. The prominent parts of the plant are the stem, with its ring (*a*); and the cap, with the gills on the under side. The cap, or pileus, as it is technically called, is the upper expanded part, and varies from 2 to 4 or 5 inches in diameter. It is usually white in color, but forms occur both in the field and in cultivation in which the upper surface is more or less brownish, especially as the plants become old. The surface is usually smooth, though it often presents a silky texture from the numerous minute fungous threads or mycelium, the structural element of the entire plant. While the surface is smooth in a majority of specimens, many forms are more or less scaly, due to the fracture of the surface and separation of the numerous small areas, especially in the specimens with brownish caps. The "flesh" or "meat" of the cap is white. The stem, or stipe, is usually cylindrical, 1–3 in. long by ½–¾ in. in diameter, whitish in color, and nearly or quite solid. The "ring," or annulus, forms a collar joined around the stem near the top. It is very delicate, easily rubbed off, and sometimes not present because the veil from which it is formed is torn in fragments as the cap opens out. The gills, or lamellæ, on the under side of the cap are of great importance in showing relationship, and also probably in reproduction in the case of plants propagated under natural conditions, since they form the fruiting surface of the Mushroom. The gills are in the form of narrow, thin plates, shaped somewhat like a knife-blade, attached by one edge to the under side of the cap and radiating from a point near the stem out to the margin of the cap. The longest gills extend for this distance and mark off triangular areas which are filled with successively shorter gills, all reaching the margin of the cap, so that the entire under surface of the cap is well covered with them. The surface of the gills is the fruiting surface of the plant, and this economy in the arrangement of the gills provides for a very large fruiting area. The color of the gills when the plant is very young is white. They soon, however, become pink in color, and as the plant ages become purple-brown or blackish in color, due to the immense number of spores borne on the surface. One can gain a good idea of the number of spores borne on a single plant by cutting a cap from a Mushroom, just at maturity, and placing it, gills downward, on a piece of white paper for a few hours. The spores fall from the gills and pile up in ridges, giving an exact print of the spaces between the gills.

The parts of the plants enumerated above are easily seen. Other important structural characters are seen with the aid of the microscope. A thin section across the gills when seen with the microscope shows the structure as seen in Fig. 1442. The middle part of the gill is the *trama*. On either side of the trama is the *subhymenium*, composed of branches from the trama and forming short cells. The cells of the subhymenium in turn give rise to the *basidia* (basidium), club-shaped bodies, which form a palisade layer of cells over the entire surface of the gill. This palisade layer of the basidia forms the fruiting surface, or *hymenium*.

At the end of each basidium are either 2 or 4 slender, pointed processes, the *sterigmata* (sing. sterigma). These bear each a single spore, the *basidiospore*. The usual number of sterigmata on the basidium in the Agaricini is 4; but in *Agaricus campestris* the number seems to vary from 2 to 4. In plants grown in a Mushroom house, 2 have been found, while plants from the field show 4. Whether the number 2 for cultivated forms is constant, or 4 for the field forms, has not been determined.

Development of Agaricus campestris.—The spores of the Mushroom in the field probably often germinate and produce new mycelium or "spawn," though this is not necessary for the continuance of the plant from one year to another, since the spawn can live through the winter in the soil, and the following year then spreads. In ordinary Mushroom culture, however, the spores probably play little part in the propagation of the plant, since this is accomplished by the growth and propagation of spawn. If the soil where plants are growing is carefully dug away there will be seen slender and irregular whitish cords coursing through it, and some of them attached to the base of the stem. These whitish cords are what the horticulturist calls "spawn." They are cords of *mycelium*, and are composed of numerous very slender and delicate whitish threads. This is the vegetative portion of the Mushroom. If the soil at the base of a tuft of young plants in a Mushroom bed be washed away, a large number of these cords will be exposed. This is the part of the plant which grows and spreads through the soil, absorbing solutions of the organic matter in the soil for food.



1441. Cultivated Mushroom, Agaricus campestris. (× ⅔.)

Button Stage.—After an abundance of the mycelium, or spawn, is formed there appear here and there on the cords small rounded bodies formed by the upward growth of the threads of mycelium. These increase in size and grow toward the surface of the ground. Each one is the young stage, or button, of the Mushroom. As it enlarges, the upper end appears as a round body on a short stalk, thus outlining in the embryonic stage the different parts of the mature plant. The gills are forming on the under side of the cap. They are at this time covered. They appear on the under side of the minute constriction at the junction of the cap and stem. At this stage they are covered by a loose growth of mycelium extending from the upper part of the stem to the margin of the cap. This forms the veil. The gills are formed by mycelium growing downward on the under side of the cap in radiating rows, thus forming the lamellæ. The plant now continues to enlarge and the cap expands. Just about maturity the veil ceases to grow and the expanding cap thus stretches it until finally the veil is ruptured, usually next the margin of the cap, and then it hangs as a collar or ring on the stem (seen at *a*, Fig. 1441).

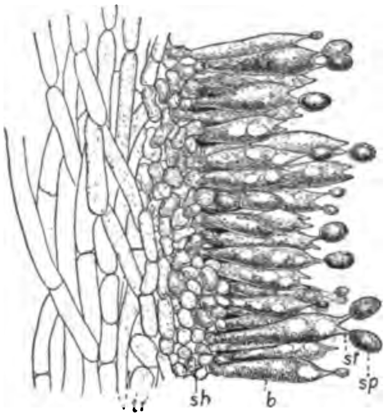
Position of Agaricus campestris in Classification.—One of the large subdivisions of the higher fungi is made up of the Mushrooms, toadstools, puff-balls, etc. All of these are characterized by a more or less well-developed fruiting surface, or *hymenium*. The structural element of the hymenium is the basidium, and in the large number of the species the form of the basidium does not vary to any great extent from that of the common Mushroom. The basidium, then, is the characteristic fruit structure of this large subdivision of the fungi. For this reason, the plants included in this subdivision are termed the *Basidiomycetes*. The Basidiomycetes, taken in the sense of the earlier students of the fungi, were divided into two orders, according to the condition of the fruiting surface at the maturity of the plant, namely the *Hymenomycetes* and the *Gasteromycetes*. In the former, the fruiting surface is either exposed from the beginning, or if covered at first, is at last exposed before the maturity of the spores, just as the hymenium of *Agaricus campestris*, at first covered by the veil, is exposed before the maturity of the spores by the rupture of the veil. The Mushrooms, toadstools, etc., belong, therefore, to the Hymenomycetes. In the Gasteromycetes, on the other hand, the spores are matured before the hymenium is exposed, as in the puff-ball, earth-star, etc., which open after the spores are ripe.

Families of the Hymenomycetes.—The usage of the earlier botanists in the arrangement of families will be followed here, since there is not an opportunity to properly set forth the principles of classification adopted by some recent systematic works. The arrangement depends on the character of the fruiting surface or hymenium.

A. Fruiting surface uneven; i. e., in the form of plates, tubes or spinous processes.
  1. Agaricaceæ, fruiting surface in the form of plates or gills.
  2. Polyporaceæ, fruiting surface in the form of pores or tubes.
  3. Hydnaceæ, fruiting surface in the form of spinous or tubercular processes.

AA. Fruiting surface even; i. e., not as in A, except in the case of plants of a gelatinous texture.
  4. Clavariaceæ, plants more or less erect, standing out from the substratum, and covered on all sides by the hymenium.
  5. Thelephoraceæ, plants either erect or diffused over the surface of the substratum, one side only (in the case of erect plants usually the under side) covered with the hymenium.
  6. Tremellineæ, plants of a gelatinous texture, various in form.

AGARICACEÆ.—The common Mushroom, *Agaricus campestris*, belongs to this family. The family Agaricaceæ is made up of what are now popularly termed *agarics*. Very many of the species were once placed in the genus Agaricus. The genus became so large that it was subdivided into a large number of subgenera, many of which have recently been raised to the rank of genera. In thus subdividing the old genus Agaricus into a number of genera there has been a lack of uniformity on the part of systematists in the choice of a generic name for the common Mushroom. Saccardo retained the genus Agaricus for the common Mushroom and its near allies, although discarding the subgenus Psalliota. Some have employed the genus Agaricus, some Psalliota, others Pratella, and still others propose to restore the antiquated genus Fungus, and call our plant *Fungus campestris*. This is not the place for a discussion of the merits of any of these names, but it seems better in the present instance, at least, to use the generic name Agaricus with the limits of Psalliota Fries.



1442. Section of a gill of Agaricus campestris, enlarged.

Tr., trama; *sh.*, hymenium; *b.*, basidium; *st.*, sterigma; *sp.*, spore.

Other Species of the Genus Agaricus.—There are a number of other species of the genus, as thus limited, which, because of their size and esculent qualities, are worthy of mention.

Agaricus arvensis, the Horse Mushroom, grows in grassy fields and pastures during the autumn. It is a larger plant than the common Mushroom, has a thicker cap, longer stem, and the veil is double, the lower or outer portion splitting radially into a star-shaped fashion and remaining attached to the inner portion. *Agaricus silvicolus*, the wood-inhabiting Mushroom, grows in woods. The whole plant is whitish, but tinged more or less with yellow, the cap is smooth, and the long stem has an abrupt and broad bulb. The veil is thin, membranaceous, but in some specimens shows a tendency to be double, as in *Agaricus arvensis*. *Agaricus Rodmani* grows along the streets of cities in the hard ground between the sidewalk and curbing, and similar places. It is entirely white, the cap thick and firm, the stem short, and with a short, thick, double annulus. *Agaricus fabaceus* (*A. subrufescens*, Peck) has a light reddish brown cap, a long stem somewhat enlarged below, and a ring which has soft scales on the under side formed, much as in *A. silvicolus*, from the cracking or splitting of the outer layer. The plant has the taste and odor of almonds. It grows in greenhouses. It sometimes grows in compost heaps. It often forms large clusters of many individuals. It has been successfully cultivated. *Agaricus silvaticus* grows in woods during late spring and summer. It is a large plant, usually about the size of the Horse Mushroom, but thinner, and with numerous minute dark scales on the surface of the cap, which form a solid patch of dark color at the center. In age, the cap is more or less flat, and it has been called the flat-cap Mushroom (*A. placomyces*). The stem is long, enlarged below, and the ring is double, exactly as in the Horse Mushroom. *Agaricus comtulus*, a small species, rather rare, but with a wide distribution, is regarded with suspicion by some.

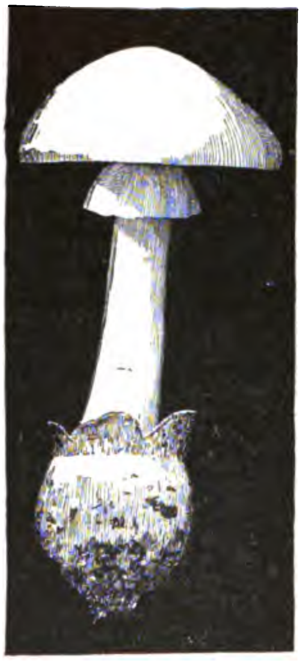
COPRINUS.—In the genus Coprinus, 3 of the edible species are quite common. The spores are black and the gills and more or less of the cap dissolve at maturity into a black fluid.

Coprinus comatus, the Shaggy-mane Mushroom, or Horse-Tail, occurs in richly manured lawns or parks in early spring or late autumn. It is white in color, with a cylindrical cap 3–4 in. long and 1–2 in. in diameter. The cap is very shaggy, the scales often being black in color, while the gills are at first salmon color. The ring on the stem is free and movable. It is one of the best of the edible Mushrooms.

Coprinus atramentarius, the Ink-cap, grows in similar places. The cap is oval, from 1–3 in. long and nearly as wide. It is nearly smooth, and grayish in color. The ring is fixed and not at all prominent; best seen just as the margin of the cap is parting from the stem.

Coprinus micaceus, the glistening Coprinus, grows about old stumps and from old roots or other buried and rotten wood. It is smaller than the two species enumerated above, and tan in color, the cap when fresh being covered with thin, loose, flaky scales which glisten in the sunlight like mica particles, but they are easily rubbed off or washed off by rains.

Lepiota.—Of the white-spored agarics the genus Lepiota, with an annulus on the stem and the gills usually free from the stem, contains several edible species. *Lepiota procera*, the Parasol Mushroom, grows in pastures, lawns, and sometimes in gardens. *Lepiota naucina*, the smooth Lepiota, grows in similar places and is entirely white.



1443. The deadly Amanita. Amanita phalloides.

Amanita.—The genus Amanita is closely related to Lepiota, and contains, besides several edible species, a number of poisonous ones, a few of which are the most deadly of all the Mushrooms. Amanita possesses the characters of Lepiota, with the additional character of a volva, or prominent universal veil, forming an outer layer of greater or lesser thickness and composition, which is ruptured as the cap expands and the stem elongates. In Lepiota the universal veil is not prominent, and it is further closely united with the surface of the cap. The volva in Amanita is often left as a prominent cup-like structure at the base of the stem (see Fig. 1443), and because it is present in some of the poisonous species is known popularly as the "poison cup," "death cup," etc. It is present, however, in some of the edible species.

Amanita phalloides, the deadly Amanita (Fig. 1443), is one of the most fatal species. It is 4 to 6 in. high, and the cap is 2 to 4 in. in diameter. The cap is dark gray or umber, or whitish with a yellowish tinge, or quite yellow, or in some forms, especially European ones, the cap is green. In other cases the whole plant may be entirely white. The volva in typical forms splits at the apex as the young plant is expanding, and is left as a cup with prominent lobes, as shown in Fig. 1443. In other cases the volva is ruptured irregularly, so that portions of the universal veil are left on the surface of the cap. In still other cases the volva splits in a circumscissile fashion, that is, circularly or transversely about the middle, the lower half remaining attached to the surface of the bulb at the base of the stem, while the upper half remains loosely attached to the upper surface of the cap, and is torn apart into scales as the cap expands. In these forms the volva forms a narrow rim or margin on the outer angle of the bulb, so that the latter appears saucer-shaped. The cap is rather slimy when moist. These great variations in this very poisonous species should make the novice very cautious regarding the species of Amanita, or indeed any species of Mushroom with which he is not quite familiar. This species of Amanita usually occurs in woods or groves or in the margins of woods, while the *Agaricus campestris* or the *Lepiota naucina* occur usually in open grassy places. But these differences of habitat cannot be relied on altogether, for the deadly Amanita, especially the white form, has been found in lawns far from woods, and in such cases might be mistaken for the smooth Lepiota, since this is white in color. The deadly Amanita is usually deeply seated in the ground, so that the stem might be broken in gathering it when the volva would be left in the ground, and it might easily be mistaken for some species of Lepiota.

Amanita verna, the Destroying Angel, is by some regarded as only a white variety of *A. phalloides*. The entire plant is white, the volva splits at the apex, and thus a prominent free limb of about three lobes remains at the base of the stem. The free limb remains more or less closely applied to the stem. The annulus is broad and entire, and hangs down as a broad collar from the upper part of the stem.

Amanita virosa is very near *A. verna*. It is distinguished only by the torn veil, portions of which remain clinging to the margin of the cap, and by the scaly character of the stem, characters which show every gradation into *A. verna*. Both are deadly poisonous.

Amanita muscaria, the Fly Agaric, is also a poisonous species, though not so dangerous as those named above, since the poisonous effect can be counteracted if treatment is promptly employed. The volva splits transversely into several concentric, interrupted rings which persist as scaly rings on the upper part of the bulb on the base of the stem, and as scattered scales on the surface of the cap. The cap is yellowish or orange-yellow, sometimes red in color, and in age sometimes fades out so that white forms appear. The gills are usually white, as are also the ring and the stem. *Amanita Frostiana* is a closely related species with the same color on the cap, but with yellowish gills and veil, though variations in the color are shown in different plants when the cap only may be yellow. The scales are usually yellow, but may also be white.

Of the edible species may be mentioned *Amanita Cæsarea*, the "Royal Agaric" or "Cæsar's Agaric." The cap is bright orange or yellow, with prominent striæ or furrows on the margin. The gills are orange, though the spores are white. The veil and stem are often yellow, especially in the larger specimens. The volva splits at the apex and is left at the base of the stem as a cup with a prominent free limb, which usually fits closely to the stem. The volva is white, and rarely are portions of it left on the surface of the cap. It is a very beautiful species, occurring during late summer and autumn in woods, and is more common in the southern states than north.

Amanita rubescens, another edible species, has a volva which is more or less friable, that is, it crumbles more or less into loose particles which easily wash off from the cap as well as from the base of the stem. The entire plant has a dull reddish tinge, and when bruised or cut quickly changes to a deeper reddish color due to a reddish juice in the plant. Small forms of the species do not show the color so well.

Amanita solitaria, the Solitary Amanita, is one of the largest species of the genus. It is almost pure white, the surface of the cap often being grayish, and sometimes with tints of brown in the scales, especially in old plants. It grows in rather open woods or by roadsides in woods. The volva is entirely broken up into mealy particles which easily rub off, or there are conic scales, especially toward the center of the cap. The veil is very delicate and easily torn into shreds, which disappear soon. The stem has a large bulb, which tapers into a long, root-like process in the soil. The plant is said by some to be edible. *Amanita strobiliformis* is a closely related species, if it is not identical with it, and is said by some to be poisonous, so that caution should be employed in eating plants of this form unless one is certain of the species and of its edible qualities. *A. strobiliformis* is rarely found in this country, and judging from the characters of certain plants attributed to it, there is a strong suspicion that it is only a form of *A. solitaria* with large scales.

Other native Mushrooms of economic importance may be mentioned:

Armillaria mellea, the Honey-colored Agaric, occurs in late summer and during the autumn about old stumps, and from roots. The plants are clustered, the cap is more or less covered with pointed blackish erect scales, the gills are attached to the stem, and an annulus is present. The plant is also a parasite, especially on the roots of coniferous trees, in some instances killing the trees. It develops under the bark long black cords of mycelium. The plant is edible.

Pleurotus contains several edible species: the oyster agaric, *P. ostreatus;* the elm Pleurotus, *P. ulmarius;* and the sapid Pleurotus, *P. sapidus*, all growing on tree trunks, stumps, etc., especially abundant in the autumn.

Tricholoma personatum, "blewits," is regarded as an excellent edible species. It grows on the ground in woods. When young, the entire plant is of a pale lilac or violet color, the color fading out in age. The spores are of a light ochre color.

Cantharellus cibarius is the well-known chanterelle. It is yellowish in color, grows in woods on the ground, is somewhat irregular top-shaped, and the gills are mere folds, which run irregularly from the stem to the margin of the cap, and are much branched. It is one of the best edible species.

Marasmius oreades, the well-known Fairy Ring, or champignon, grows in lawns and pastures. It is white, with a cream-colored cap. It often grows in the form of rings on the ground, though not always.

The genus Lactarius contains a large number of species. The plants are more or less fleshy and are characterized by the presence of a milky juice contained in a system of tubes throughout the plant. This juice exudes in drops when the plant is bruised or cut. In the larger number of species the juice is white in color, in some it changes on exposure to the air to various shades of yellow, while in others the milk is orange, blue, etc., from the first. *Lactarius deliciosus* is one of the best of the edible species, as its name indicates. The milk is orange in color. The plant is dull orange in color and marked on the cap with concentric zones of darker color. In age bruises of the plant become more or less tinged with green. *Lactarius volemus* is dull orange in color, the color being uniform, the flesh quite firm, and the milk white, sweet and very abundant, quickly exuding in large drops or running from cut or cracked portions. *Lactarius corrugis* is closely related but darker in color, sometimes dark brown, the gills also being dark ochre-brown in color. Both species are excellent, and grow in the woods during summer and autumn. *Lactarius piperatus* is entirely white, with close and narrow white gills, and abundant milk which is very hot or peppery to the taste. It is said to be edible, but should not be confused with certain species having peppery milk, which are reputed to be poisonous. *Lactarius resimus* is another white species with white and very hot milk, which is suspected. *Lactarius Indigo* is of an indigo-blue color, with faint zones of a darker color on the cap, and with a dark indigo-blue juice.

The genus Russula is closely related to Lactarius, but lacks the milky juice. In this genus occur many of the brilliant-colored agarics. The entire plant is more or less brittle and easily breaks, the gills of many species crumbling easily when rubbed. *Russula lepida*, with reddish cap and stem, white gills with the red color from the cap extending a short distance on the ends of the gills, taste mild, is an edible species. Another edible species, *Russula alutacea*, has a reddish or purple cap, but the gills and spores are ochraceous in color. The taste is mild. *Russula emitica* is a poisonous species. The cap is rose-color or red, the cuticle easily peels off from the cap, the margin of the cap is deeply furrowed and warty along the ridges, the stem is white or reddish and the taste of the plant is peppery.

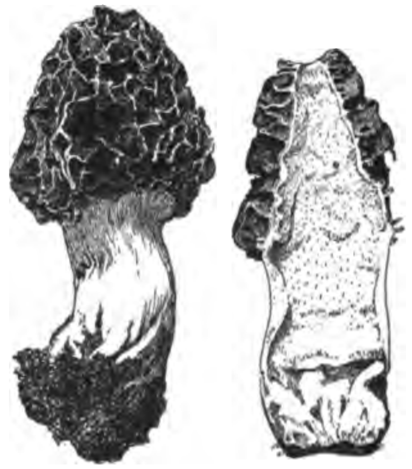
Of the tube-bearing Fungi (*Polyporaceæ*) the genus *Boletus* contains a number of edible as well as poisonous species. In shape the plants are like the Mushroom, but they have a porous surface instead of gills on the under side of the cap. *Boletus edulis* has a yellowish or dull brownish cap, pores white and closed at first, but yellowish or greenish yellow in age. *Boletus felleus* (poisonous) is of about the same size and resembles the edible species closely, but the tube surface is pink or flesh-color, and the taste is bitter. In the genus *Polyporus* most of the species grow on wood, trees, stumps, logs, branches, roots, etc. The sulfur polyporus, *P. sulphureus*, forms clusters of sulfur-yellow bracket-like caps, on various broad-leaved trees or stumps. *Polyporus frondosus* grows from roots at the base of dead oak stumps, forming large irregularly branched leafy masses with gray caps and whitish stems and pore surface. Both of these are edible.

In the spine-bearing Fungi (*Hydnaceæ*) the under surface of the cap presents numerous spine-like processes. *Hydnum repandum*, in shape like a Mushroom, with the cap more or less irregular, and of a buff or cream color, is an excellent edible species. The Coral Hydnum, the Bear's Head, the Medusa's Head, and *Hydnum erinaceum*, all growing on trees, all white in color, and branched, or forming large masses from which long spines dangle, are all edible.

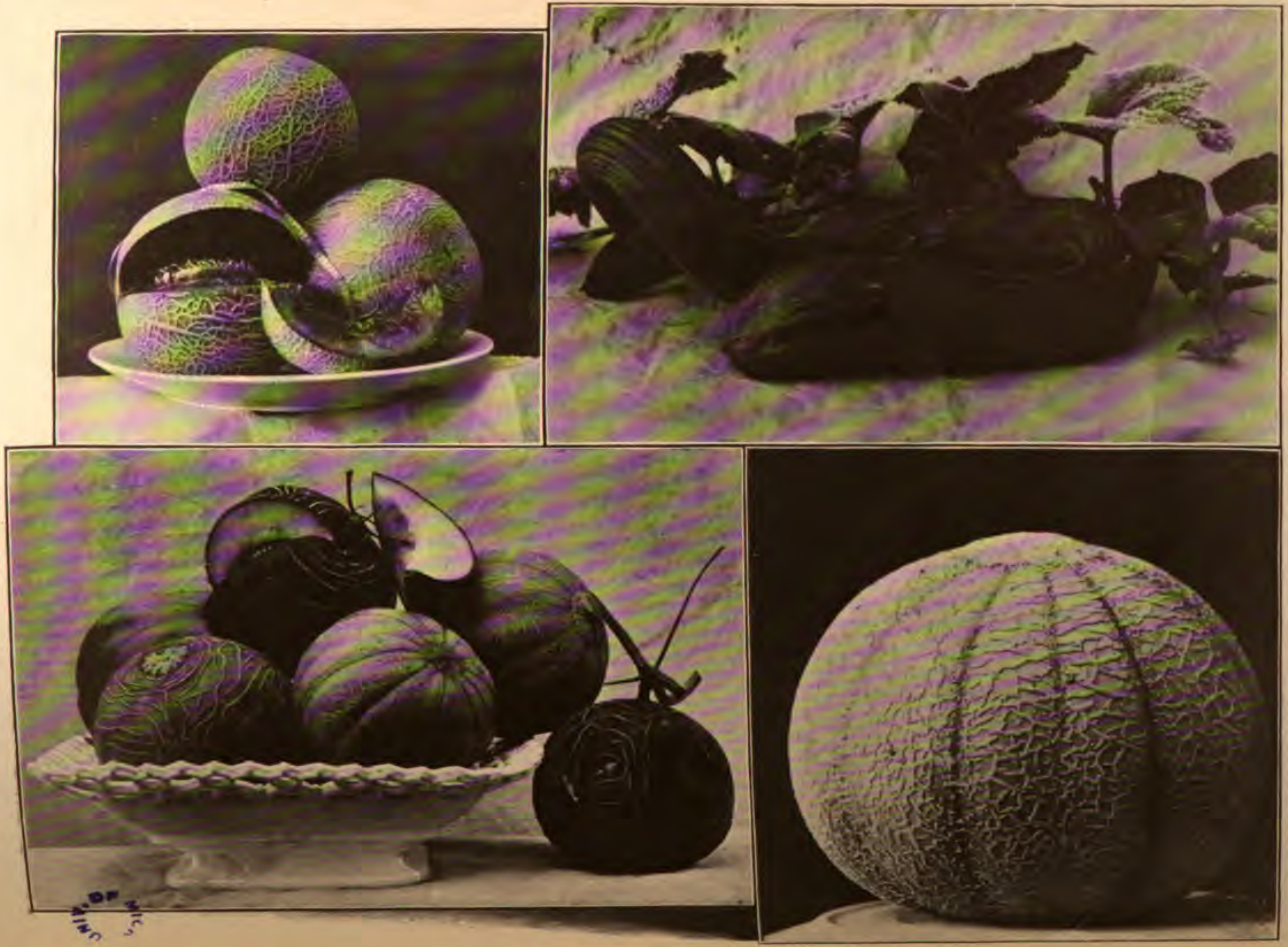
The Club Fungi (*Clavariaceæ*) are all said to be edible. The Horn of Plenty, *Craterellus cornucopioides*, funnel-shaped, and smoky in color, with a smooth under surface, belongs to the *Thelephoraceæ*, and is edible.

Among the Puff-balls (*Lycoperdaceae*) all the species when young and white inside are edible, that is, they are not poisonous. Some are better to the taste than others. The two best ones are the Giant Puff-ball, *Lycoperdon giganteum* and the *Lycoperdon cyathiforme*. Both of these grow in lawns or fields, the former grows sometimes to a large size, several feet in diameter; while the latter is 4 to 6 inches in diameter.

Besides the Mushrooms proper which belong to the Basidiomycetas, certain of the large Ascomycetes are edible and are usually included in treatises on Mushrooms. In the Ascocomycetes the spores are borne on the inside of a club-shaped body called the *ascus*, and this is the chief point of difference in them from the Basidiomycetes. To the Ascomycetes belong the following. The Morels grow on the ground in damp places. They have a stout stem and a rounded or more or less elongated cap which is deeply and coarsely pitted. *Morchella esculenta*, represented in Fig. 1444, shows well the general character of the genus. In Helvella, containing several edible species, the cap is in the form of several (usually two) irregular flaps, sometimes free below from the stem, sometimes united with it. Lastly, the Truffles might be mentioned. They are subterranean Fungi rounded or globose in form, firm,



1444. Morel—Morchella esculenta (× ½).



UNIV. OF MICH.

Plate XIX. Types of Muskmelons.

In the fruit-dish, varieties of Forcing Melons. In the opposite corners, Netted Melons. In the upper right-hand corner, the Snake Cucumber, *Cucumis Melo*, var. *flexuosus*.